UNIVERSAL DISPLAY CORP \PA\
Form 10-K
February 21, 2019

UNITED STATES

SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

FORM 10-K

(Mark One)

ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the fiscal year ended December 31, 2018

OR

TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the transition period from _____ to _____

Commission File Number 1-12031

UNIVERSAL DISPLAY CORPORATION

(Exact name of registrant as specified in its charter)

Pennsylvania	23-2372688
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)
375 Phillips Boulevard, Ewing, New Jersey	08618

(Address of principal executive offices) (Zip Code)
Registrant's telephone number, including area code: (609) 671-0980

Securities registered pursuant to Section 12(b) of the Act:

Title of Each Class	Name of Each Exchange on Which Registered
Common Stock, $0.01 par value	The NASDAQ Stock Market LLC

Securities registered pursuant to Section 12(g) of the Act: None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes No

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes No

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes No

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§ 232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes No

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained, to the best of registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K.

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer	Accelerated filer
Non-accelerated filer	Smaller reporting company
	Emerging growth company

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. Yes No

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). Yes No

The aggregate market value of the voting and non-voting common equity held by non-affiliates of the registrant computed by reference to the closing sale price of the registrant's common stock on the NASDAQ Global Market as of June 30, 2018, was $3,632,483,050. Solely for purposes of this calculation, all executive officers and directors of the registrant and all beneficial owners of more than 10% of the registrant's common stock (and their affiliates) were considered affiliates.

As of February 18, 2019, the registrant had outstanding 47,110,375 shares of common stock.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's Proxy Statement for the 2019 Annual Meeting of Shareholders, which is to be filed with the Securities and Exchange Commission no later than April 30, 2019, are incorporated by reference into Part III of this report.

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CAUTIONARY STATEMENT

CONCERNING FORWARD-LOOKING STATEMENTS

This report and the documents incorporated by reference in this report contain some “forward-looking statements” within the meaning of Section 27A of the Securities Act of 1933 and Section 21E of the Securities Exchange Act of 1934. Forward-looking statements concern possible or assumed future events, results and business outcomes. These statements often include words such as “believe,” “expect,” “anticipate,” “intend,” “plan,” “estimate,” “seek,” “will,” “may,” “ similar expressions. These statements are based on assumptions that we have made in light of our experience in the industry, as well as our perceptions of historical trends, current conditions, expected future developments and other factors we believe are appropriate under the circumstances.

As you read and consider this report, you should not place undue reliance on any forward-looking statements. You should understand that these statements involve substantial risk and uncertainty and are not guarantees of future performance or results. They depend on many factors that are discussed further under Item 1A (Risk Factors) below, including:

- successful commercialization by organic light emitting diode (OLED) manufacturers of products incorporating our OLED technologies and materials and their continued willingness to utilize our OLED technologies and materials;
- the adequacy of protections afforded to us by the patents that we own or license and the cost to us of maintaining, enforcing and defending those patents;
- our ability to obtain, expand and maintain patent protection in the future, and to protect our non-patented intellectual property;
- our exposure to and ability to defend third-party claims and challenges to our patents and other intellectual property rights;
- our ability to maintain and improve our competitive position following the expiration of certain of our fundamental phosphorescent organic light-emitting diode (PHOLED) patents;
- our ability to form and continue strategic relationships with manufacturers of OLED products;
- the payments that we expect to receive under our existing contracts with OLED manufacturers and the terms of contracts that we expect to enter into with OLED manufacturers in the future;
- the potential commercial applications of and future demand for our OLED technologies and materials, and of OLED products in general;
- our customers’ willingness to continue to purchase our materials in the event of substantial increases in tariffs or restrictions resulting from international trade disputes;
- our customers' development and use of more efficient manufacturing processes and material processing protocols that result in the more efficient utilization of our materials, and therefore reduce their requirements for our materials;
- the comparative advantages and disadvantages of our OLED technologies and materials versus competing technologies and materials currently in the market;
- the nature and potential advantages of any competing technologies that may be developed in the future;
- the outcomes of our ongoing and future research and development activities, and those of others, relating to OLED technologies and materials;
- our ability to access future OLED technology developments of our academic and commercial research partners;
- our ability to acquire and supply OLED materials at cost competitive pricing;
- our ability to compete against third parties with resources greater than ours;
- our ability to respond to and address malicious cybersecurity and IT infrastructure attacks;
- our future capital requirements and our ability to obtain additional financing if and when needed;
- our quarterly cash dividend policy;
- our future OLED technology licensing and OLED material revenues and results of operations, including supply and demand for our OLED materials; and
- general economic and market conditions.

Changes or developments in any of these areas could affect our financial results or results of operations and could cause actual results to differ materially from those contemplated by any forward-looking statements.

All forward-looking statements speak only as of the date of this report or the documents incorporated by reference, as the case may be. We do not undertake any duty to update, correct, modify, or supplement any of these forward-looking statements to reflect events or circumstances after the date of this report or to reflect the occurrence of unanticipated events.

PART I

ITEM 1. BUSINESS

Our Company

We are a leader in the research, development and commercialization of organic light emitting diode, or OLED, technologies and materials for use in display and solid-state lighting applications. OLEDs are thin, lightweight and power-efficient solid-state devices that emit light that can be manufactured on both flexible and rigid substrates, making them highly suitable for use in full-color displays and as lighting products. OLED displays are capturing a growing share of the display market, especially in the mobile phone, television, augmented reality, virtual reality and automotive markets. We believe that this is because OLEDs offer potential advantages over competing display technologies with respect to power efficiency, contrast ratio, viewing angle, video response time, form factor and manufacturing cost. We also believe that OLED lighting products have the potential to replace many existing light sources in the future because of their high power efficiency, excellent color rendering index, low operating temperature and novel form factor. Our technology leadership and intellectual property position should enable us to share in the revenues from OLED displays and lighting products as they continue to be more broadly adopted.

Our primary business strategy is to (1) further develop and license our proprietary OLED technologies to manufacturers of products for display applications, such as mobile phones, wearable electronic devices, tablets, notebook computers and televisions, and specialty and general lighting products; and (2) develop new OLED materials and sell the materials to those product manufacturers. We have established a significant portfolio of proprietary OLED technologies and materials, primarily through our internal research and development efforts and acquisitions of patents and patent applications, as well as maintaining our relationships with world-class universities and other partners such as Princeton University (Princeton), the University of Southern California (USC), the University of Michigan (Michigan) and PPG Industries, Inc. (PPG). We currently own, exclusively license or have the sole right to sublicense more than 5,000 patents issued and pending worldwide.

We sell our proprietary OLED materials to customers for evaluation and use in commercial OLED products. We also enter into agreements with manufacturers of OLED display and lighting products under which we grant them licenses to practice under our patents and to use our proprietary know-how. At the same time, we work with these and other companies who are evaluating our OLED technologies and materials for possible use in commercial OLED display and lighting products.

Market Overview

The Display Panel Market

Thin, energy efficient display panels that can be manufactured on glass or flexible substrates are essential for a wide variety of portable consumer electronics products, such as mobile phones, AR/VR headsets, digital cameras, wearables, tablets and notebook computers. Due to their narrow profile and light weight, flat panel displays have also become the display of choice for larger product applications, such as computer monitors and televisions.

Liquid crystal displays, or LCDs, continue to dominate the flat panel display market. However, we believe that OLED displays are an attractive alternative to LCDs because they offer a number of potential advantages, including:

- higher power efficiencies, thereby reducing energy consumption;
- a thinner profile and lighter weight;
- higher contrast ratios, leading to sharper picture images and graphics;
- wider viewing angles;
- deposition on non-rigid substrates which enable conformable and flexible displays;
- faster response times for video; and

- lower cost manufacturing methods and materials.

Based on these characteristics, product manufacturers have adopted small-area OLED displays for use in a wide variety of electronic devices, such as smartphones, wearables and tablets. Manufacturers are increasingly commercializing large area OLED displays for use in televisions. We believe that if these efforts are successful, they could result in sizeable markets for OLED displays.

In addition, due to the inherent transparency of organic materials and through the use of transparent electrode technology, OLEDs eventually may enable the production of transparent displays for use in products such as automotive windshields and windows with embedded displays. Organic materials also make technically possible the development of flexible displays for use in an entirely new set of product applications. Such applications include display devices that can be folded or conformed to various shapes for wearable, industrial and ruggedized applications.

The Solid-State Lighting Market

Traditional incandescent light bulbs are inefficient because they convert only about 5% of the energy they consume into visible light, with the rest emerging as heat. Fluorescent lamps use excited gases, or plasmas, to achieve a higher energy conversion efficiency of about 20%. However, the color rendering index, or CRI, of most fluorescent lamps – in other words, the quality of their color compared to an ideal light source – is inferior to that of an incandescent bulb. Fluorescent lamps also pose environmental concerns because they typically contain mercury.

Solid-state lighting relies on the direct conversion of electricity to visible light using semiconductor materials. By avoiding the heat and plasma-producing processes of incandescent bulbs and fluorescent lamps, respectively, solid-state lighting products can have substantially higher energy conversion efficiencies.

There are currently two basic types of solid-state lighting devices: inorganic light emitting diodes, or LEDs, and OLEDs. Current LEDs are very small in size (about one square millimeter) and are extremely bright. Having been developed about 25 years before OLEDs, LEDs are already employed in a variety of lighting products, such as traffic lights, billboards, replacements for incandescent lighting, backlights for smartphones, computer monitors and televisions, and as border or accent lighting. However, the high operating temperatures and intense brightness of LEDs may make them less desirable for many general illumination and diffuse lighting applications.

OLEDs, on the other hand, are larger in size and can be viewed directly, without using diffusers that are required to temper the intense brightness of LEDs. OLEDs can be fabricated onto any suitable surface, including glass, plastic or metal foil, and could be cost-effective to manufacture in high volume. Given these characteristics, product manufacturers are working and have introduced limited product applications of OLEDs for diffuse specialty lighting applications and ultimately general illumination. If these efforts are successful, we believe that OLED lighting products could begin to be used for applications currently addressed by incandescent bulbs and fluorescent lamps, as well as for new applications that take advantage of the OLED form factor. In particular, the ability of OLED technology to produce uniform illumination over arbitrary shapes is making OLED lighting very attractive to the automobile industry.

Our Competitive Strengths

We believe our position as one of the leading technology developers in the OLED industry is the direct result of our technological innovation. We have built an extensive intellectual property portfolio around our OLED technologies and materials, and are working diligently to enable our manufacturing partners to adopt our OLED technologies and materials for expanding commercial usage. Our key competitive strengths include:

Technology Leadership

We are a recognized technology leader in the OLED industry. Along with our research partners, we have pioneered the development of our UniversalPHOLED® phosphorescent OLED technologies, which can be used to produce OLEDs that are up to four times more efficient than fluorescent OLEDs and significantly more efficient than current LCDs, which are illuminated using backlights. We believe that our phosphorescent OLED technologies and materials are well-suited for industry usage in the commercial production of OLED displays and lighting products. Through our relationships with companies such as PPG and our academic partners, we have also developed other important OLED technologies, as well as novel OLED materials that we believe will facilitate the adoption of our various OLED technologies by product manufacturers.

Broad Portfolio of Intellectual Property

We believe that our extensive portfolio of patents, trade secrets and non-patented know-how provides us with a competitive advantage in the OLED industry. Through our internal development efforts, acquisitions, and our

relationships with world-class partners such as Princeton, USC, Michigan and PPG, we own, exclusively license or have the sole right to sublicense more than 5,000 patents issued and pending worldwide. In 2011, we purchased 74 issued U.S. patents from Motorola Solutions, Inc. (f/k/a Motorola, Inc.) (Motorola), together with foreign counterparts in various countries, which patents we had previously licensed from Motorola, and in 2012, we acquired the entire worldwide patent portfolio of more than 1,200 OLED patents and patent applications of Fujifilm Corporation (Fujifilm). In 2016, we acquired more than 500 issued and then pending patents in the area of phosphorescent materials and technologies from BASF SE (BASF). We also continue to accumulate valuable non-patented technical know-how relating to our OLED technologies and materials.

Leading Supplier of UniversalPHOLED® Emitter Materials

We are the leading supplier of phosphorescent emitter materials to OLED product manufacturers. The emitter material, which is designed to efficiently convert electrical energy to a desired wavelength of light, is the key component in an OLED device. We develop, supply, and offer for sale proprietary phosphorescent emitter materials. PPG currently manufactures our materials for us, which we then qualify and resell to OLED product manufacturers. We record revenues based on our sales of these materials to OLED product manufacturers. Our sales allow us to maintain close technical and business relationships with the OLED product manufacturers purchasing our proprietary materials, which in turn further supports our technology licensing business.

Established Material Supply Relationships

We have established relationships with well-known manufacturers that are using, or are evaluating for use, our OLED materials in commercial products. In 2018, our customers for such materials included Samsung Display Co., Ltd. (SDC), LG Display Co., Ltd. (LG Display), AU Optronics Corporation (AU Optronics), BOE Technology Group Co., Ltd. (BOE), Konica Minolta Holdings Inc. (Konica Minolta), Tianma Micro-electronics Co., Ltd. (Tianma), Tohoku Pioneer Corporation, Innolux Corporation (Innolux) (formerly Chimei Innolux Corporation), Kaneka Corporation (Kaneka), EverDisplay Optronics (Shanghai) Limited and Visionox Technology, Inc. (Visionox), among others.

Licensing Our OLED Technologies and Patents

We license our proprietary OLED technologies and patents to product manufacturers on a non-exclusive basis. We do not directly manufacture or sell OLED display or lighting products. Instead, we enter into licensing arrangements with OLED product manufacturers who pay us license fees and/or royalties based on their sales of licensed products. We believe this business model allows us to concentrate on our core strengths of technology development and innovation, while at the same time providing significant operating leverage. We also believe that this approach may reduce potential competitive conflicts with our customers.

Licenses with Key Product Manufacturers

We have licensed our OLED technologies and patents to manufacturers for use in commercial products. In 2018, we had license agreements for the manufacture and sale of certain display products with SDC (as successor to Samsung Mobile Display Co. Ltd.), LG Display, BOE, Tianma, and Visionox. We also have license agreements with Konica Minolta, Sumitomo Chemical Company, Ltd. (Sumitomo), Pioneer Corporation (Pioneer), Kaneka and OLEDWorks L.L.C. (OLEDWorks) for the manufacture of OLED lighting products. Additionally, we have a license agreement with DuPont Displays for its manufacture of solution-processed OLED display products using proprietary OLED materials obtained through us.

Complementary UniversalPHOLED® Host Material Business

We develop, supply and offer for sale certain of our proprietary phosphorescent host materials to OLED product manufacturers. In one design, the emitter material is disbursed into a host material, with the resulting mixture consisting of predominantly host material. We believe that host material sales can be complementary to our phosphorescent emitter material sales business; however, our OLED product manufacturing customers are not required to purchase our host materials in order to utilize our phosphorescent emitter materials. In addition, the host material business is more competitive than the phosphorescent emitter material sales business. This means our long-term prospects for host material sales are uncertain.

Experienced Management and Scientific Advisory Team

Our management team has significant experience in developing business models focused on licensing disruptive technologies in high growth industries. In addition, our management team has assembled a Scientific Advisory Board that includes some of the leading researchers in the OLED industry, such as Professor Stephen R. Forrest of Michigan (formerly of Princeton) and Professor Mark E. Thompson of USC.

Our Business Strategy

Our current business strategy is to promote and continue to expand our portfolio of OLED technologies and materials for widespread use in OLED displays and lighting products. We generate revenues primarily by selling our proprietary OLED materials and licensing our OLED technologies to display and lighting product manufacturers. We are presently focused on the following steps to implement our business strategy:

Target Leading Product Manufacturers and Developers

We are targeting leading manufacturers of displays and lighting products as potential commercial licensees of our OLED technologies and purchasers of our OLED materials. We also supply our proprietary OLED materials to manufacturers and developers of OLED displays and lighting products for evaluation and for use in product development and for pre-commercial activities, and we provide technical assistance and support to these manufacturers and developers. We concentrate on working closely with OLED product manufacturers and developers because we believe that the successful incorporation of our technologies and materials into commercial products is critical to their widespread adoption.

Enhance Our Existing Portfolio of PHOLED Technologies and Materials

We believe that a strong portfolio of proprietary OLED technologies and materials for both displays and lighting products is critical to our success. Consequently, we are continually seeking to expand this portfolio through our internal development efforts, our collaborative relationships with academic and other research partners, and other strategic opportunities. One of our primary goals is to develop new and improved phosphorescent OLED (PHOLED) technologies and materials with increased efficiencies, enhanced color gamut and extended lifetimes, which are compatible with different manufacturing methods, so that they can be used by various manufacturers in a broad array of OLED display and lighting products.

Develop Next-Generation Organic Technologies

We continue to conduct research and development activities relating to next-generation OLED technologies for both displays and lighting products. We also are funding research by our academic partners on the use of organic thin-film technology in other applications. Our focus on next-generation technologies is designed to enable us to maintain our position as a leading provider of OLED and other organic electronics technologies and materials as new markets emerge.

Business and Geographic Markets

We derive revenue from the following:

- sales of OLED materials for evaluation, development and commercial manufacturing;
- intellectual property and technology licensing;
- contract research services in the areas of organic and organometallic materials synthesis research, development and commercialization; and
- technology development and support, including government contract work and support provided to third parties for commercialization of their OLED products.

Most manufacturers of displays and lighting products who are or might potentially be interested in our OLED technologies and materials are currently located outside of the United States, particularly in the Asia-Pacific region. To provide on-the-ground support to these manufacturers, we have established wholly-owned subsidiaries in Ireland, Korea, Japan, China and Hong Kong, as well as a representative office in Taiwan. Our subsidiary in Ireland is responsible for all material sales world-wide (excluding the United States) and for licensing and managing intellectual property and undertaking certain other business transactions in all non-U.S. territories.

We receive a majority of our revenues from customers that are domiciled outside of the United States, and our business is heavily dependent on our relationships with these customers. In particular, two of our key customers located in the Asia-Pacific region, SDC and LG Display, accounted for 37% and 33%, respectively, of our consolidated revenues for 2018. Substantially all revenue derived from our customers is denominated in U.S. dollars.

For more information on our revenues, costs and expenses associated with our business, as well as a breakdown of revenues from North America and foreign sources, please see our Consolidated Financial Statements and the notes thereto, as well as “Management’s Discussion and Analysis of Financial Condition and Results of Operations,” included elsewhere in this report.

Our Technology and its Relation to OLED Technology and Structure

OLED devices are solid-state semiconductor devices made from thin films of organic material that emit light of various wavelengths when electricity is selectively applied to the emissive layer of the device. OLED devices are typically referred to as incorporating an “OLED stack.” OLED stacks vary in specific structure but those commonly used today may include a cathode, an electron injection layer, an electron transport layer, an emissive layer, a hole transport layer, a hole injection layer and an anode, all of which are placed on a substrate which may be made of a number of different materials, including glass, plastic and metal.

Our technology and materials are most commonly utilized in the emissive layer; the materials in the emissive layer are the light-generating component of the OLED stack. Many of our key technologies relate primarily to phosphorescent emitter materials, which we believe are more energy efficient than fluorescent emitter materials that can also be used to generate light within the emissive layer of the OLED device. We began selling emitter materials commercially in 2003. A manufacturer will use a small amount of emitter material for each device through a process called “doping” into a host material. The emitter material(s) and the host material(s) together form an emissive layer system. Depending on the nature of the OLED device, the emissive materials and emissive layer system may be designed to emit different colors. We have commercially produced and sold phosphorescent emitter materials that produce red, yellow, green and light-blue light, which are combined in various ways for the display and lighting markets.

Our current materials business, conducted outside the United States by our Irish subsidiary, is focused primarily on the delivery of such emissive materials. We have also developed host materials for the emissive layer and began selling them commercially in 2011. In addition to our materials, which are protected by patents covering various molecular structures, we also have fundamental and important patents that cover various aspects of the OLED device and OLED manufacturing processes. These patents are important to our licensing business because they enable us to provide our business partners important OLED related technologies.

Our Phosphorescent OLED Technologies

Phosphorescent OLEDs utilize specialized materials and device structures that allow OLEDs to emit light through a process known as phosphorescence. Traditional fluorescent OLEDs emit light through an inherently less efficient process. Theory and experiment show that phosphorescent OLEDs exhibit device efficiencies up to four times higher than those exhibited by fluorescent OLEDs. Phosphorescence substantially reduces the power requirements of an OLED and is useful in displays for hand-held devices, such as smartphones, where battery power is often a limiting factor.

Phosphorescence is also important for large-area displays such as televisions, where higher device efficiency and lower heat generation may enable longer product lifetimes and increased energy efficiency.

We have a strong intellectual property portfolio surrounding our existing PHOLED technologies and materials for both displays and lighting products which we market under the UniversalPHOLED® brand. We devote a substantial portion of our efforts to developing new and improved proprietary PHOLED materials and device architectures for red, green, yellow, blue and white OLED devices. In 2018, we continued our commercial supply relationships with companies such as SDC, LG Display, Tianma, BOE and Visionox to use such materials to manufacture OLED displays. In addition, we continued to work closely with customers evaluating and qualifying our proprietary PHOLED materials for commercial usage in both displays and lighting products, and with other material suppliers to match our PHOLED emitters with their phosphorescent hosts and other OLED materials.

Our Additional Proprietary OLED Technologies

Our intellectual property, research, development and commercialization efforts also encompass a number of other OLED device and manufacturing technologies, including the following:

FOLED ™ Flexible OLEDs

We are working on a number of technologies required for the fabrication of OLEDs on flexible substrates. Most OLED and other flat panel displays are built on rigid glass substrates. In contrast, FOLEDs are OLEDs built on non-rigid substrates such as plastic or metal foil. This has the potential to enhance durability and enable conformation to certain shapes or repeated bending or flexing. Many OLED smartphone displays are built on plastic substrates including those produced by SDC. One of our customers, LG Display, demonstrated a 65-inch rollable FOLED display at the 2019 CES (Consumer Electronics Show) in Las Vegas. The commercial introduction of such FOLED

product offerings demonstrates the viability of new display product applications that do not exist commercially today, such as portable, roll-up Internet connectivity and communications devices as well as enhance the usefulness of such devices in ruggedized, industrial and wearable computing systems. Manufacturers also may be able to produce FOLEDs using more efficient continuous, or roll-to-roll, processing methods. Our internal research and development efforts are expected to enhance and promote the future adoption of consumer and industrial FOLED devices.

Thin-Film Encapsulation

We have developed proprietary, patented encapsulation technology for the packaging of flexible OLEDs and other thin-film devices, as well as for use as a barrier film for plastic substrates. Addressing a major roadblock to the successful commercialization of flexible OLEDs, our hybrid, multi-layer approach provides barrier performance useful for OLEDs using a potentially cost-effective process. In addition to accelerating the commercial viability of flexible OLEDs, our thin-film encapsulation technology has the potential to provide benefits for a variety of other flexible thin-film devices, including photovoltaics and thin-film batteries.

UniversalP^2 OLED® Printable Phosphorescent OLEDs

The standard approach for manufacturing a small molecule OLED, including a PHOLED, is based on a vacuum thermal evaporation, or VTE, process. With a VTE process, the thin layers of organic material in an OLED are deposited in a high-vacuum environment. An alternate approach for manufacturing a small molecule OLED involves solution processing of the various organic materials in an OLED using techniques such as spin coating or inkjet printing onto the substrate. Solution-processing methods, and inkjet printing in particular, have the potential to be scalable to large area displays.

OVJP® Organic Vapor Jet Printing

OLEDs could be manufactured using other processes as well, including OVJP. As a direct printing technique, OVJP technology has the potential to offer high deposition rates for large area OLEDs. In addition, OVJP technology reduces OLED material waste associated with use of a shadow mask (i.e., the waste of material that deposits on the shadow mask itself when fabricating an OLED). By comparison to inkjet printing, an OVJP process does not use liquid solvents and therefore the OLED materials utilized are not limited by their viscosity or solvent solubility. OVJP also avoids generation of solvent wastes and eliminates the additional step of removing residual solvent from the OLED device. We have installed a prototype OVJP tool at our Ewing, New Jersey facility, and we continue to collaborate on OVJP technology development with Professor Forrest of Michigan.

OVPD® Organic Vapor Phase Deposition

Another approach for manufacturing a small molecule OLED is based on OVPD. The OVPD process utilizes a carrier gas, such as nitrogen, in a hot walled reactor in a low pressure environment to deposit the layers of organic material in an OLED. The OVPD process may offer advantages over the VTE process or solution processing methods through more efficient materials utilization and enhanced deposition control. We have licensed Aixtron AG, a leading manufacturer of metal-organic chemical vapor deposition equipment, to develop and qualify equipment for the fabrication of OLED displays utilizing the OVPD process.

TOLED Transparent OLEDs

We have developed a technology for the fabrication of OLEDs that have transparent cathodes. Conventional OLEDs use a reflective metal cathode and a transparent anode. In contrast, TOLEDs use a transparent cathode and either a transparent, reflective or opaque metal anode. TOLEDs utilizing transparent cathodes and reflective metal anodes are known as “top-emission” OLEDs. In a “top-emission” AMOLED, light is emitted without having to travel through much of the device electronics where a significant portion of the usable light is lost. This results in OLED displays having image qualities and lifetimes superior to those of conventional “bottom emitting” AMOLEDs. TOLEDs utilizing transparent cathodes and transparent anodes may also be useful in novel flat panel display applications requiring semi-transparency or transparency, such as graphical displays in automotive windshields and retail window signage.

Our Strategic Relationships with Product Manufacturers

We have established early-stage evaluation programs, development and pre-commercial programs, and commercial arrangements with a substantial number of manufacturers or potential manufacturers of OLED display and lighting products. Many of these relationships are directed towards tailoring our proprietary OLED technologies and materials for use by individual manufacturers. Our ultimate objective is to license our OLED technologies and sell our OLED materials to these manufacturers for their commercial production of OLED products.

Relationships with OLED Display Manufacturers

We license our OLED technologies and patents to display manufacturers for use in commercial products and supply our proprietary OLED materials to these manufacturers for both commercial use and evaluative purposes. We have been collaborating with some of these display manufacturers for many years.

We have been working with SDC and providing our PHOLED materials to SDC for evaluation since 2001. Under the terms of a 2011 patent license agreement, we licensed our patents and technologies to SDC for its manufacture and sale of AMOLED display products. Under the terms of a 2011 supplemental purchase agreement, we supplied our proprietary PHOLED materials to SDC for its use in manufacturing licensed products. We also continue to supply SDC with our proprietary UniversalPHOLED materials for use in its development efforts under a 2001 joint development agreement.

The 2011 license and purchase agreements with SDC expired on December 31, 2017, and on February 13, 2018, we entered into new patent license and supplemental purchase agreements, both with an effective date of January 1, 2018. These agreements, which cover the manufacture and sale of specified OLED display materials, last through the end of 2022 with an additional two-year

extension option. Under these agreements, the Company is being paid a license fee, payable in quarterly installments over the agreement term of five years. These agreements convey to SDC the non-exclusive right to use certain of the Company's intellectual property assets for a limited period of time that is less than the estimated life of the assets. The 2018 supplemental purchase agreement provides for certain minimum annual purchase obligations of phosphorescent emitter material from us for use in the manufacture of licensed products. SDC is currently the largest manufacturer of AMOLED displays for handset and other personal electronic devices.

We have been working with LG Display or its affiliates for over 15 years. In 2015, the Company entered into an OLED patent license agreement and an OLED commercial supply agreement with LG Display which were effective as of January 1, 2015 and superseded the existing 2007 commercial supply agreement between the parties. The new agreements have a term that is set to expire by the end of 2022. The patent license agreement provides LG Display a non-exclusive, royalty bearing portfolio license to make and sell OLED displays under the Company's patent portfolio. The patent license calls for license fees, prepaid royalties and running royalties on licensed products. The agreements include customary provisions relating to warranties, indemnities, confidentiality, assignability and business terms. The agreements provide for certain other minimum obligations relating to the volume of material sales anticipated over the life of the agreements as well as minimum royalty revenue to be generated under the patent license agreement. The Company expects to generate revenue under these agreements that are predominantly tied to LG Display’s sales of OLED licensed products. The OLED commercial supply agreement provides for the sale of materials for use by LG Display, which may include phosphorescent emitters and host materials.

In 2016, the Company entered into long-term, multi-year OLED patent license and material purchase agreements with Tianma. Under the license agreement, the Company has granted Tianma non-exclusive license rights under various patents owned or controlled by the Company to manufacture and sell OLED display products. The license agreement calls for license fees and running royalties on licensed products. Additionally, the Company supplies phosphorescent OLED materials to Tianma for use in its licensed products.

In 2017, the Company entered into long-term, multi-year agreements with BOE. Under these agreements, the Company has granted BOE non-exclusive license rights under various patents owned or controlled by the Company to manufacture and sell OLED display products. The Company has also agreed to supply phosphorescent OLED materials to BOE.

In 2018, the Company entered into long-term, multi-year OLED patent license and material purchase agreements with Visionox. Under the license agreement, the Company has granted Visionox non-exclusive license rights under various patents owned or controlled by the Company to manufacture and sell OLED display products. The license agreement calls for license fees and running royalties on licensed products. Additionally, the Company expects to supply phosphorescent OLED materials to Visionox for use in its licensed products.

We have been collaborating with AU Optronics since 2001, and we continue to provide our proprietary PHOLED materials to AU Optronics under a 2016 commercial supply agreement through which AU Optronics also has certain license rights.

We also continue to support numerous display manufacturers in their evaluation of our technologies and proprietary OLED materials, through evaluation arrangements in which we provide our proprietary OLED materials to such manufacturers for limited scale commercial production, evaluation and for purposes of development, manufacturing qualification and product testing. Many of these strategic relationships have been in place for longer than a decade, and we continue to establish new relationships.

Relationships with OLED Lighting Manufacturers

We license our OLED technologies and patents to lighting manufacturers for use in commercial products and supply our proprietary OLED materials to these manufacturers for both commercial use and evaluative purposes. Many of

these strategic relationships have also been in place for longer than a decade.

Since 2004, we have been supporting Konica Minolta in its efforts to develop OLED lighting products. We continue to license our patents and technology to Konica Minolta under a 2008 OLED technology license agreement for its manufacture and sale of OLED lighting products that utilize our phosphorescent and other OLED technologies. We also continue to provide Konica Minolta with our proprietary PHOLED materials for its manufacture of commercial OLED lighting products under a 2011 commercial material supply agreement, and for evaluation purposes under a 2012 evaluation agreement.

We also continue to license our OLED patents to Sumitomo under a 2015 OLED patent portfolio license agreement in which we granted Sumitomo a non-exclusive, world-wide, royalty bearing license to make and sell OLED lighting panels using a solution-based manufacturing process. Under the license agreement, Sumitomo may also purchase certain of our phosphorescent materials.

We continue to supply LG Display with materials in connection with the OLED lighting business it acquired from LG Chem, Ltd. (LG Chem) in 2015-2016. This lighting business continues to generate commercial chemical sales and license fee revenues under a limited-term commercial sales agreement we signed with LG Chem prior to its acquisition.

We continue to license our OLED patents, and to provide our OLED materials, to OLEDWorks for use in OLED lighting products under patent license and commercial supply agreements signed in 2015. We have also extended the rights under these agreements to OLEDWorks GmbH, the German company and facility that OLEDWorks acquired in 2015 from Philips Technologie GmbH.

We continue to license our technologies and patents to Kaneka for the manufacture and sale of OLED lighting products, under the terms of a 2013 license agreement, and we continue to supply our materials to Kaneka under a 2014 commercial material supply agreement. We also have a license agreement for the manufacture and sale of OLED lighting products with Pioneer, among others.

Similar to our arrangements with display manufacturers, we continue to support numerous lighting manufacturers in their evaluation of our technologies and proprietary OLED materials, typically through evaluation agreements under which we provide our proprietary OLED materials to such manufacturers for evaluation and potential commercial application.

Relationships with Manufacturers for Other Commercial Products

In addition to our relationships with lighting and display manufacturers, we have agreements and arrangements with manufacturers or potential manufacturers to use our proprietary OLED technologies and materials in other commercial products, such as in automotive interiors and exteriors.

Our OLED Materials Manufacturing Business

We supply our proprietary UniversalPHOLED® materials to display manufacturers, lighting manufacturers and others. We qualify our materials in OLED devices before shipment in order to ensure that they meet required specifications. We believe that our inventory-carrying practices, along with the terms under which we sell our OLED materials (including payment terms), are typical for the markets in which we operate. In 2018, our OLED materials business received recertification in accordance with ISO 9001:2015 Quality Management Systems. In 2018, UDC’s Ewing, NJ facility also received certification in accordance with ISO 14001:2015 Environmental Management Systems.

PPG

We have maintained a close working relationship with PPG since 2000. In 2011, we entered into an agreement with PPG, the term of which continues through December 31, 2019 and shall be automatically renewed for additional one year terms, unless terminated by us with prior notice of one year or terminated by PPG with prior notice of two years. Under that agreement, PPG is responsible, under our direction, for manufacturing scale-up of our proprietary OLED materials, and for supplying us with those materials. We use these materials for our own research and development as well as for resale to our customers, both for their evaluation and for use in commercial OLED products. Through our collaboration with PPG, key raw materials are sourced from multiple suppliers to ensure that we are able to meet the needs of our customers on a timely basis. We have not had any issues with obtaining access to adequate amounts of any key raw materials.

We invested a total of $15.6 million from 2016 through 2018 in PPG’s Barberton, Ohio manufacturing facility, to approximately double commercial production capacity for our UniversalPHOLED® phosphorescent emitter products. The expansion project was completed and operational during 2018.

Collaborations with Other OLED Material Manufacturers

We continued our non-exclusive collaborative relationships with other manufacturers of OLED materials during 2018. Most of these relationships are focused on matching our proprietary PHOLED emitters with hosts and other

OLED materials of these companies. We believe that collaborative relationships such as these are important for ensuring success of the OLED industry and broader adoption of our PHOLED and other OLED technologies.

Research and Development

Our research and development activities are focused on the advancement of our OLED technologies and materials for displays, lighting and other applications. We conduct this research and development both internally and through various relationships with our commercial business partners and academic institutions.

Internal Development Efforts

We conduct a substantial portion of our OLED development activities at our state-of-the-art development and testing facility in Ewing, New Jersey. At this expanded facility, which now exceeds 50,000 square feet, we perform technology development, including device and process optimization, prototype fabrication, manufacturing scale-up studies, process and product testing, characterization and reliability studies, and technology transfer with our business partners.

Our Ewing facility houses multiple OLED deposition systems, including a full-color flexible OLED system and an OVJP organic vapor jet printing system. In addition, the facility contains equipment for substrate patterning, organic material deposition, display packaging, module assembly and extensive testing in Class 100 and 100,000 clean rooms and opto-electronic test laboratories. Our facility also includes state-of-the-art synthetic and analytical chemistry laboratories in which we conduct OLED materials research and make small quantities of new materials that we then test in OLED devices.

In 2016, we acquired Adesis, Inc. (Adesis). Adesis is a contract research organization (CRO) that provides support services to the OLED, pharma, biotech, catalysis and other industries. Adesis currently operates in a facility of over 47,500 square feet in New Castle, Delaware and 7,000 square feet in Wilmington, Delaware. As of December 31, 2018, Adesis employed a team of 84 research and development chemists, engineers and laboratory technicians. Prior to our acquisition, we utilized more than 50% of Adesis' technology service and production output. Although we expect to continue to utilize the majority of its technology research capacity for the benefit of our OLED technology development, Adesis is expected to continue operating as a CRO in the above mentioned industries.

As of December 31, 2018, we employed a team of 182 research scientists, engineers and laboratory technicians at our domestic and international facilities. This team includes chemists, physicists, engineers and technicians with physics, electrical engineering, mechanical engineering and organic/inorganic chemistry backgrounds, and highly-trained theoreticians and experimentalists.

University Sponsored Research

We have long-standing relationships with Princeton University and USC, dating back to 1994, for the conduct of research relating to our OLED and other organic thin-film technologies and materials for applications such as displays and lighting. This research had been performed at Princeton under the direction of Professor Forrest and at USC under the direction of Professor Thompson. In 2006, Professor Forrest transferred to the University of Michigan, where we continue to fund his research.

We funded research at Princeton under a research agreement executed in 1997 (the 1997 Research Agreement). The 1997 Research Agreement was allowed to expire in 2007, after Professor Forrest transferred to Michigan. We have exclusive license rights to all OLED and other thin-film organic electronic patents (other than for organic photovoltaic solar cells) arising out of research conducted under that agreement.

In connection with Professor Forrest's transfer to Michigan, in 2006 we entered into a new sponsored research agreement with USC under which we are funding organic electronics research being conducted by Drs. Forrest and Thompson (the 2006 Research Agreement). Work by Professor Forrest is being funded through a subcontract between USC and Michigan. As with the 1997 Research Agreement, we have exclusive license rights to all OLED and thin-film organic electronic patents (other than for organic photovoltaic solar cells) arising out of this research.

Effective May 1, 2017, we amended the 2006 Research Agreement once again to extend the term of the agreement for an additional three years. As of December 31, 2018, in connection with this amendment, we are obligated to reimburse the universities up to $4.1 million for work to be performed during the remaining extended term, which expires April 30, 2020.

In 2005, we entered into a separate sponsored research agreement with Princeton to fund research under the direction of Professor Sigurd Wagner on thin-film encapsulation and fabrication of OLED devices. This research was completed as of December 31, 2013. Like our other relationships with Princeton, we have exclusive license rights to all patents arising out of the research.

We entered into a contract research agreement with the Chitose Institute of Science and Technology of Japan (CIST) in 2004. Under that agreement, we funded a research program headed by Professor Chihaya Adachi relating to high-efficiency OLED materials and devices. We were granted exclusive rights to all intellectual property developed under this program. Our relationship with CIST ended in 2006 when Professor Adachi transferred to Kyushu University. However, we have continued our relationship with Professor Adachi under a separate consulting arrangement.

In 2006 and 2007, we entered into one-year research agreements with Kyung Hee University to sponsor research programs on flexible, amorphous silicon thin-film transistor (TFT) backplane technology. The programs were directed by Professor Jin Jang. In 2008 and 2009, we entered into contract research agreements with Silicon Display Technology, Ltd. (SDT), a company founded by Professor Jang, and in 2013, we entered into another one-year agreement with SDT. We continue to maintain a good working relationship with Professor Jang.

Aixtron

In 2000, we entered into a development and license agreement with Aixtron AG of Aachen, Germany to develop and commercialize equipment used in the manufacture of OLEDs using the OVPD process. Under this agreement, we granted Aixtron an exclusive license to produce and sell its equipment for the manufacture of OLEDs and other devices using our proprietary OVPD process. Aixtron is required to pay us royalties on its sales of this equipment. Purchasers of the equipment also must obtain rights to use our proprietary OVPD process to manufacture OLEDs and other devices using the equipment, which they may do through us or Aixtron. If these rights are granted through Aixtron, Aixtron is required to make additional payments to us under our agreement.

Aixtron has reported to us the delivery of nine OVPD systems since 2002. These include two second-generation systems, one of which was sold to the Fraunhofer Institute for Photonic Microsystems in Dresden, Germany in 2007, and the other of which was sold to RiTdisplay Corporation of Taiwan in 2003. We record royalty income from Aixtron’s sales of these various systems in the quarters in which Aixtron notifies us of the sale and the related royalties are due.

U.S. Government-Funded Research

We have entered into several U.S. government contracts and subcontracts to fund a portion of our efforts to develop next-generation OLED technologies. On contracts for which we were the prime contractor, we subcontract portions of the work to various entities and institutions. All of our government contracts and subcontracts are subject to termination at the election of the contracting governmental agency.

Our government-funded programs are concentrated primarily in the area of solid-state lighting. In the past, we have received support for our work on flexible OLED technology through various U.S. Department of Defense (DOD) agencies, including the Army Research Laboratory (ARL), the Air Force Research Laboratory (AFRL), the Army Communications-Electronics Research Development and Engineering Center (CERDEC) and the National Science Foundation (NSF). The U.S. Department of Energy (DOE) supports our work on white OLEDs for lighting, including through its Solid State Lighting (SSL) initiative. Several of our key U.S. government program initiatives in 2018 were as follows:

Technology Development for OLED Lighting

During 2018, we received funding from the DOE to work with the University of Michigan on a contract to develop technical approaches for using our proprietary PHOLED and other OLED technologies for high-efficiency white lighting applications.

OLED Association

We are a charter member of the OLED Association (OLED-A). OLED-A is a trade association whose mission involves serving as an OLED information resource, driving OLED technology development, and promoting interest in OLED products. We are one of 17 members of OLED-A, and we actively participate on its marketing and technology committees. Dr. Mike Hack, our Vice President of Business Development, serves as a member of the Board of Directors of OLED-A.

Next Generation Lighting Industry Alliance

We joined the Next Generation Lighting Industry Alliance (NGLIA) in 2009. NGLIA was formed in 2003 to foster industry-government partnership to accelerate the technical foundation, and ultimate commercialization, of solid state lighting systems. NGLIA was designated in 2005 as the “industry partner” by DOE for its SSL program. The SSL program is being undertaken to research, develop and conduct demonstration activities on advanced solid state white lighting technologies based on LEDs and OLEDs. We are one of 9 members of NGLIA. Dr. Hack is currently Vice-Chairman of NGLIA.

OLED Lighting Coalition

We are a founding member of the OLED Lighting Coalition, a subgroup of OLED-A and NGLIA. The OLED Lighting Coalition is a group of U.S. companies and advocates of OLED technology joined together to promote the OLED lighting industry to the government, public and the lighting community. Dr. Hack serves as a member of the Board of Directors of the OLED Lighting Coalition.

Intellectual Property

Along with our personnel, our primary and most fundamental assets are patents and other intellectual property. This includes numerous U.S. and foreign patents and patent applications that we own, exclusively license or have the sole right to sublicense. It also includes a substantial body of non-patented technical know-how that we have accumulated over time.

Our Patents

Our research and development activities, conducted both internally and through collaborative programs with our partners, have resulted in the filing of a substantial number of patent applications relating to our OLED technologies and materials. As of December 31, 2018, we owned, through assignment to us alone or jointly with others, 402 pending U.S. applications (active U.S. cases and international applications designated in the U.S.) and 837 U.S. patents, together with counterparts filed in various foreign countries. These owned patents will start expiring in the U.S. in 2020.

Patents We License from Princeton, USC and Michigan

We exclusively license many of our patent rights, including certain of our key PHOLED technology patents, under the 1997 Amended License Agreement. In 2006, based on Professor Forrest's transfer to Michigan that year, Michigan was added as a party to this agreement. As of December 31, 2018, the patent rights we license from these universities included 228 issued U.S. patents, 61 pending U.S. patent applications, together with counterparts filed in various foreign countries. The earliest of these patents expired in the U.S. in 2014, while one of our U.S. PHOLED technology patents licensed from these universities expired in 2017.

Under the 1997 Amended License Agreement, Princeton, USC and Michigan granted us worldwide, exclusive license rights to specified patents and patent applications relating to OLED technologies and materials (including our PHOLED technology and materials). Our license rights also extend to any patent rights arising out of the research conducted by Princeton, USC or Michigan under our various research agreements with these entities. We are free to sublicense to third parties all or any portion of our patent rights under the 1997 Amended License Agreement. The term of the 1997 Amended License Agreement continues for the lifetime of the licensed patents, though it is subject to termination for an uncured material breach or default by us, or if we become bankrupt or insolvent.

Princeton is primarily responsible for the filing, prosecution and maintenance of all patent rights licensed to us under the 1997 Amended License Agreement pursuant to an inter-institutional agreement between Princeton, USC and Michigan. However, we manage this process and have the right to instruct patent counsel on specific matters to be covered in any patent applications filed by Princeton. We are required to bear all costs associated with the filing, prosecution and maintenance of these patent rights.

We are required under the 1997 Amended License Agreement to pay Princeton royalties for licensed products sold by us or our sublicensees. These royalties amount to 3% of the net sales price for licensed products sold by us and 3% of the revenues we receive for licensed products sold by our sublicensees. These royalty rates are subject to renegotiation for products not reasonably conceivable as arising out of the research agreements if Princeton reasonably determines that the royalty rates payable with respect to these products are not fair and competitive. Princeton shares portions of

these royalties with USC and Michigan under their inter-institutional agreement.

We have a minimum royalty obligation of $100,000 per year during the term of the 1997 Amended License Agreement. We owed royalties under the 1997 Amended License Agreement with Princeton of $7.0 million for 2018. We also are required under the 1997 Amended License Agreement to use commercially reasonable efforts to bring the licensed OLED technology to market. However, this requirement is deemed satisfied if we invest a minimum of $800,000 per year in research, development, commercialization or patenting efforts respecting the patent rights licensed to us under the 1997 Amended License Agreement.

Patents We Acquired from Motorola

In 2000, we entered into a license agreement with Motorola whereby Motorola granted us perpetual license rights to what are now 74 issued U.S. patents relating to Motorola’s OLED technologies, together with foreign counterparts in various countries. These patents expired in the U.S. during 2018.

In 2011, we purchased these patents from Motorola, including all existing and future claims and causes of action for any infringement of the patents. This effectively terminated our license agreement with Motorola, including any obligation to make royalty payments to Motorola. In consideration for Motorola assigning and transferring the patents to us, we made a one-time cash payment to Motorola of $440,000, and we granted Motorola a royalty-free, non-exclusive and non-sublicensable license under the patents for use by Motorola and its affiliates in their respective businesses.

Patents We Acquired from Fujifilm Corporation

In 2012, we entered into a Patent Sale Agreement (the Fujifilm Agreement) with Fujifilm. Under the Fujifilm Agreement, Fujifilm sold more than 1,200 OLED-related patents and patent applications for a total cost of $109.5 million. The Fujifilm Agreement contains customary representations and warranties and covenants, including respective covenants not to sue by both parties thereto. The Fujifilm Agreement permitted us to assign all of our rights and obligations under the Fujifilm Agreement to our affiliates, and we assigned, prior to the consummation of the transactions contemplated by the Fujifilm Agreement, our rights and obligations to UDC Ireland Limited (UDC Ireland), a wholly-owned subsidiary formed under the laws of the Republic of Ireland. The transactions contemplated by the Fujifilm Agreement were consummated on July 26, 2012.

Patents We Acquired from BASF

In 2016, our Irish subsidiary UDC Ireland entered into an IP Transfer Agreement (the BASF Agreement) with BASF. Under the BASF Agreement, BASF sold us more than 500 OLED-related patents and patent applications for a total cost of $96.0 million. The transactions contemplated by the BASF Agreement were consummated on June 28, 2016.

Intellectual Property Developed under Our Government Contracts

We and our subcontractors have developed, and may continue to develop, patentable OLED technology inventions under our various U.S. government contracts and subcontracts. Under these arrangements, we or our subcontractors generally can elect to take title to any patents on these inventions, and to control the manner in which these patents are licensed to third parties. However, the U.S. government reserves rights to these inventions and associated technical data that could restrict our ability to market them to the government for military and other applications, or to third parties for commercial applications. In addition, if the U.S. government determines that we or our subcontractors have not taken effective steps to achieve practical application of these inventions in any field of use in a reasonable time, the government may require that we or our subcontractors license these inventions to third parties in that field of use.

Non-patented Technical Know-How

We have accumulated, and continue to accumulate, a substantial amount of non-patented technical know-how relating to OLED technologies and materials. Where practicable, we share portions of this information with display manufacturers and other business partners on a confidential basis. We also employ various methods to protect this information from unauthorized use or disclosure, although no such methods can afford complete protection. Moreover, because we derive some of this information and know-how from academic institutions such as Princeton, USC and Michigan, there is an increased potential for public disclosure. We also cannot prevent the actual independent development of the same or similar information and know-how by third parties.

Competition

The industry in which we operate is highly competitive. We compete against alternative display technologies, in particular LCDs, as well as other OLED technologies. We also compete in the lighting market against incumbent technologies, such as incandescent bulbs, fluorescent lamps, and inorganic LEDs, and against emerging technologies, such as other OLED technologies.

Display Panel Industry Competitors

Numerous domestic and foreign companies have developed or are developing and improving LCD and other display technologies that compete with our OLED display technologies. We believe that OLED display technologies can compete with LCDs and other display technologies for many product applications on the basis of lower power consumption, better contrast ratios, faster video rates, form factor and lower manufacturing cost. However, other companies may succeed in continuing to improve these competing display technologies, or in developing new display technologies, that are superior to OLED display technologies in various respects. We cannot predict the timing or extent to which such improvements or developments may occur.

Lighting Industry Competitors

Although there has been a movement to phase out traditional incandescent bulbs throughout many countries, traditional incandescent bulbs and fluorescent lamps remain well-entrenched products in the lighting industry. In addition, compact fluorescent lamps and solid-state LEDs have been introduced into the market and would compete with OLED lighting products. Having attributes different from fluorescent lamps and LEDs, OLEDs may compete directly with these products for certain lighting applications. However, manufacturers of LEDs and compact fluorescent lamps may succeed in more broadly adapting their products to various lighting applications, or others may develop competing solid-state lighting technologies that are superior to OLEDs. Again, we cannot predict whether or when this might occur.

OLED Technology and Materials Competitors

Eastman Kodak Company (Kodak) developed and patented the original fluorescent OLED technology in 1987. Cambridge Display Technology, Ltd. (CDT), which was acquired by Sumitomo Chemical Company in 2007, developed and patented polymer OLED technology in 1989. Display and lighting manufacturers, including customers of ours, are engaged in their own OLED research, development and commercialization activities, and have developed and may continue to develop proprietary OLED technologies that are necessary or useful for commercial OLED devices. In addition, other material manufacturers, such as Sumitomo, Idemitsu Kosan Co., Ltd. (Idemitsu Kosan), Merck KGaA, Cynora Gmbh and Kyulux Inc., are selling or sampling competing OLED materials to customers, including companies to which we sell our proprietary PHOLED materials.

Our licensing business is based on our control of a broad portfolio of OLED-related device patents and technology. We believe this portfolio includes fundamental patents in the field of phosphorescent OLED materials and devices, as well as certain additional complementary OLED technologies. As discussed above, alternative technologies, such as fluorescent OLED emitter materials, exist and could be competitive to our phosphorescent OLED material solutions. However, fluorescent materials have characteristics that we believe many market participants consider less desirable than those of phosphorescent materials. Suppliers of fluorescent emitter materials include Doosan Electronics, Dow Chemical (previously Gracel Display), Idemitsu Kosan and SFC Co. Ltd. Fluorescent materials may also be viewed as complementary in that they can be used in the same OLED stack as phosphorescent materials, especially for use as emitters for generating deep blue pixels in display modules until such time as the OLED industry improves the properties of currently available deep blue phosphorescent materials.

The competitive landscape with respect to our host materials business is characterized by a larger number of established chemical material suppliers who have long-term relationships with many of our existing customers and licensees. We have elected to partner with certain of these companies to manufacture and deliver host solutions to our customers, as well as selling our host materials directly to device manufacturers. We believe our competitive advantage stems, in part, from our deep knowledge of our phosphorescent emitter materials, which are complementary with the host solutions. We believe that our understanding of the phosphorescent emitter materials enables us to create host material solutions that are especially well suited for use with a certain class of emitter materials that are implemented commercially today. However, we note that many of our technology partners have their own host solutions and the competitive landscape includes many well-established companies such as Doosan Electronics, Dow Chemical, Duksan, Idemitsu Kosan, Merck KGaA, NSCC and Samsung SDI Co. Ltd. and which have significant resources and may aggressively pursue such business in the future.

Our existing business relationships with SDC and other product manufacturers suggest that our OLED technologies and materials, particularly our PHOLED technologies and materials, may achieve a significant level of market penetration in the display and lighting industries. However, others, such as those working to develop thermally activated delayed fluorescence (TADF) and micro-LED alternative technologies, may succeed in developing new OLED technologies, materials and alternative solutions that may supplement or be utilized in place of ours. We cannot be sure of the extent to which product manufacturers will adopt and continue to utilize our OLED technologies and

materials for the production of commercial displays and lighting products.

Our Contract Research Organization Business: Adesis, Inc.

Adesis, which we acquired in July 2016, is a contract research organization (CRO) headquartered in New Castle, Delaware that provides support services to the OLED, pharma, biotech, catalysis and other industries. As of December 31, 2018, Adesis employed a team of 84 research and development chemists, engineers and laboratory technicians. Prior to our acquisition in 2016, we utilized more than 50% of Adesis' technology service and production output. We continue to utilize a significant portion of its technology research capacity for the benefit of our OLED technology development, and Adesis uses the remaining capacity to operate as a CRO in the above-mentioned industries.

In May 2017, Adesis purchased its New Castle, Delaware building, to expand its custom organic synthesis, research and development, and specialty manufacturing capabilities. The New Castle facility is a 47,500-square-foot building in the Southgate Industrial Center, of which Adesis had previously leased about 25,100 square feet. We believe the purchase of the building will allow Adesis to continue to expand its CRO offerings and allow us to enhance our chemistry expertise and capabilities.

In December 2017, Adesis signed an agreement with Delaware Innovation Space, Inc. for approximately 7,000 square feet of laboratory space at the Experimental Station in Wilmington, Delaware, in which Adesis opened a new suite of laboratories to expand its organic chemistry team and research and development programs. The Wilmington space includes additional ancillary work and meeting space and supports Adesis' ongoing operations.

Employees

As of December 31, 2018, we had 265 active full-time employees and two part-time employees, none of whom are unionized. We believe that relations with our employees are good.

Our Company History

Our corporation was organized under the laws of the Commonwealth of Pennsylvania in 1985. Our business was commenced in 1994 by a company then known as Universal Display Corporation, which had been incorporated under the laws of the State of New Jersey. In 1995, a wholly-owned subsidiary of ours merged into this New Jersey corporation. The surviving corporation in this merger became a wholly-owned subsidiary of ours and changed its name to UDC, Inc. Simultaneously with the consummation of this merger, we changed our name to Universal Display Corporation. UDC, Inc. functions as an operating subsidiary of ours and has certain overlapping officers and directors. We have also formed or acquired other wholly-owned subsidiaries, including Universal Display Corporation Hong Kong, Limited (2008), Universal Display Corporation Korea, Y.H. (2010), Universal Display Corporation Japan GK (2011), UDC Ireland Limited (2012), Universal Display Corporation China, Ltd. (2016) and Adesis, Inc. (2016), and we established a representative office in Taiwan (2011).

Our Compliance with Environmental Protection Laws

We are not aware of any material effects that compliance with Federal, State or local environmental protection laws or regulations will have on our business. We have not incurred substantial costs to comply with any environmental protection laws or regulations, and we do not anticipate having to do so in the foreseeable future.

Our Internet Site

Our Internet address is www.oled.com. We make available through our Internet website, free of charge, our annual reports on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K and amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Securities Exchange Act of 1934 as soon as reasonably practicable after we file such material with the Securities and Exchange Commission (the SEC). The SEC maintains a website that contains these reports as well as proxy statements and information regarding issuers who file electronically, with the address www.sec.gov. In addition, we have made available on our Internet website under the heading "Corporate Governance" the charter for the Audit Committee of our Board of Directors, the charter for the Compensation Committee of our Board of Directors, the charter for the Nominating & Corporate Governance Committee of our Board of Directors, our Code of Ethics & Business Conduct for Employees, our Code of Conduct for Directors, and our Corporate Governance Guidelines. We intend to make available on our website any future amendments or waivers to our Code of Ethics & Business Conduct for Employees and our Code of Conduct for Directors. The information on our Internet site is not part of this report.

ITEM 1A. RISK FACTORS

You should carefully consider the following risks and uncertainties when reading this Annual Report on Form 10-K. The following factors, as well as other factors affecting our operating results and financial condition, could cause our actual future results and financial condition to differ materially from those projected.

If we cannot obtain and maintain appropriate patent and other intellectual property protection for our OLED technologies and materials, our business will suffer.

The value of our OLED technologies and materials is dependent on our ability to secure and maintain appropriate patent and other intellectual property rights protection. Although we own or license many patents respecting our OLED technologies and materials that have already been issued, there can be no assurance that additional patents applied for will be obtained, or that any of these patents, once issued, will afford commercially significant protection for our OLED technologies and materials, or will be found valid if challenged. Also, there is no assurance that we will be successful in defending the validity of our current or future patents in

pending and future patent oppositions, invalidation trials, interferences, reexaminations, reissues, or other administrative or court proceedings. Moreover, we have not obtained patent protection for some of our OLED technologies and materials in all foreign countries in which OLED products or materials might be manufactured or sold.

We believe that the strength of our current intellectual property position results primarily from the essential nature of our fundamental patents covering phosphorescent OLED devices and certain materials utilized in these devices. Certain of our existing fundamental phosphorescent OLED patents expired in the United States in 2017 or will expire in the United States in 2019; and expired in other countries of the world in 2018 or will expire in other countries of the world in 2020. While we hold a wide range of additional patents and patent applications whose expiration dates extend (and in the case of patent applications, will extend) beyond 2020, many of which are also of importance in the OLED industry, none are of an equally essential nature as our fundamental patents, and therefore our competitive position may be less certain as these patents expire.

We may become engaged in litigation to protect or enforce our patent and other intellectual property rights, or in International Trade Commission proceedings to abate the importation of goods that would compete unfairly with those of our licensees. In addition, we are participating in or have participated in, and in the future will likely have to participate in, interference, reissue, or reexamination proceedings before the U.S. Patent and Trademark Office, and opposition, nullity or other proceedings before foreign patent offices, with respect to some of our patents or patent applications. All of these actions place our patents and other intellectual property rights at risk and may result in substantial costs to us as well as a diversion of management attention from our business and operations. Moreover, if successful, these actions could result in the loss of patent or other intellectual property rights protection for the key OLED technologies and materials on which our business depends.

We rely, in part, on several non-patented proprietary technologies to operate our business. Others may independently develop the same or similar technologies or otherwise obtain access to our unpatented technologies. Furthermore, these parties may obtain patent protection for such technology, inhibiting or preventing us from practicing the technology. To protect our trade secrets, know-how and other non-patented proprietary information, we require employees, consultants, financial advisors and strategic partners to enter into confidentiality agreements. These agreements may not ultimately provide meaningful protection for our trade secrets, know-how or other non-patented proprietary information. In particular, we may not be able to fully or adequately protect our proprietary information as we conduct discussions with potential strategic partners. Additionally, although we take many measures to prevent theft and misuse of our proprietary information, we may face attempts by others to gain unauthorized access through the Internet to our information technology systems or to our intellectual property, which might be the result of industrial or other espionage or actions by hackers seeking to harm our company or its products. If we are unable to protect the proprietary nature of our technologies, it will harm our business.

We or our customers may incur substantial costs or lose important rights as a result of litigation or other proceedings relating to our patent and other intellectual property rights or with respect to our OLED materials business.

There are a number of other companies and organizations that have been issued patents and are filing patent applications relating to OLED technologies and materials, including, without limitation, Kodak (substantially all of whose OLED assets were sold to a group of LG companies in 2009), CDT (acquired by Sumitomo in 2007), Canon, Inc., Semiconductor Energy Laboratories Co., Idemitsu Kosan and Mitsubishi Chemical Corporation. In addition, some of our customers such as SDC and LG Display have been issued patents and are filing patent applications relating to OLED technologies and materials. As a result, there may be issued patents or pending patent applications of third parties that would be infringed by the use of our OLED technologies or materials, thus subjecting our customers to possible suits for patent infringement in the future. Such lawsuits could result in our customers being liable for damages or require our customers to obtain additional licenses that could increase the cost of their products. This, in turn, could have an adverse effect on our customers' sales and thus our royalties or material sales revenues, or cause our customers to seek to renegotiate our royalty rates or pricing. In addition, we have agreed to

indemnify customers purchasing our OLED materials for commercial usage against certain claims of patent infringement by third parties, as a result of which we may incur substantial legal costs in connection with defending these customers from such claims.

Our licensees may also seek to avoid paying future royalties by attempting to have our patents declared invalid and unenforceable by a court. Our licensees may be more likely to file such declaratory actions in light of the U.S. Supreme Court's decision in MedImmune, Inc. v. Genentech, Inc. (2007), in which the Court found that a licensee need not refuse to pay royalties and commit material breach of the license agreement before bringing an action to declare a licensed U. S. patent invalid and unenforceable.

In addition, we may be required, from time-to-time, to assert our intellectual property rights by instituting legal proceedings against others. We cannot be assured that we will be successful in enforcing our patents in any lawsuits we may commence. Defendants in any litigation we may commence to enforce our patents may attempt to establish that our patents are invalid or are unenforceable. Thus, any patent litigation we commence could lead to a determination that one or more of our patents are invalid or unenforceable. If a third party succeeds in invalidating one or more of our patents, that party and others could compete more effectively against us. Our ability to derive licensing revenues from products or technologies covered by these patents would also be adversely affected.

Whether our customers are defending the assertion of third-party intellectual property rights against their businesses arising as a result of the use of our technology, or we are asserting our own intellectual property rights against others, such litigation can be complex, costly, protracted and highly disruptive to our or our customers' business operations by diverting the attention and energies of management and key technical personnel. As a result, the pendency or adverse outcome of any intellectual property litigation to which we or our customers are subject could disrupt business operations, require the incurrence of substantial costs and subject us or our customers to significant liabilities, each of which could severely harm our business. Costs associated with these actions are likely to increase as AMOLED products using our PHOLED and other OLED technologies and materials continue to enter the consumer marketplace.

Plaintiffs in intellectual property cases often seek injunctive relief in addition to money damages. Any intellectual property litigation commenced against our customers may force them to take actions that could be harmful to their businesses and thus to revenues, including the halting of sales of products that incorporate or otherwise use our technology or materials.

Furthermore, the measure of damages in intellectual property litigation can be complex and is often subjective or uncertain. If our customers were to be found liable for infringement of proprietary rights of a third party, the amount of damages they might have to pay could be substantial and is difficult to predict. Decreased sales of our customers' products incorporating our technology or materials would have an adverse effect on our royalty revenues under existing licenses and material sales under our existing sales agreements. Were this to occur, it would likely harm our ability to (i) obtain new licensees which would have an adverse effect on the terms of the royalty arrangements we could enter into with any new licensees, and (ii) sell our UniversalPHOLED® materials to existing and new customers. Moreover, to the extent any third party claims are directed specifically to materials supplied by us to our customers, we may be required to incur significant costs associated with the defense of such claims and potential damages associated with such claims that may be awarded against our customers.

As is commonplace in technology companies, we employ individuals who were previously employed at other technology companies. To the extent our employees are involved in research areas that are similar to those areas in which they were involved at their former employers, we may be subject to claims that such employees or we have, inadvertently or otherwise, used or disclosed the alleged trade secrets or other proprietary information of the former employers. Litigation may be necessary to defend against such claims. The costs associated with these actions or the loss of rights critical to our or our customers' businesses could negatively impact our revenues or cause our business to fail.

Recent court decisions in various patent cases may make it more difficult for us to obtain future patents, enforce our patents against third parties or obtain favorable judgments in cases where the patents are enforced.

Recent case law may make it more difficult for patent holders to secure future patents and/or enforce existing patents. For example, in KSR International Co. vs. Teleflex, Inc. (2007), the U.S. Supreme Court mandated a more expansive and flexible approach to determine whether a patent is obvious and invalid. As a result of the less rigid approach to assessing obviousness, defending the validity of or obtaining patents may be more difficult.

Recent court decisions may also impact the enforcement of our patents. For example, we may not be able to enjoin certain third party uses of products or methods covered by our patents following the initial authorized sale, even where those uses are expressly proscribed in an agreement with the buyer. Also, we may face increased difficulty enjoining infringement of our patents. The U.S. Supreme Court has held that an injunction should not automatically issue based on a finding of patent infringement, but should be determined based on a test balancing considerations of the patentee's interest, the infringer's interest, and the public's interest. Obtaining enhanced damages for willful infringement of our patents may also be more difficult even in those cases where we successfully prove a third party has infringed our patents, as a recent case set a more stringent standard for proving willful infringement.

Therefore, as a result of such rulings, it may be more difficult for us to defend our currently issued patents, obtain additional patents in the future or achieve the desired competitive effect even when our patents are enforced. If we are unable to so defend our currently issued patents, or to obtain new patents for any reason, our business would suffer.

If we cannot form and maintain lasting business relationships with OLED product manufacturers, our business strategy will fail.

Our business strategy ultimately depends upon our development and maintenance of commercial licensing and material supply relationships with high-volume manufacturers of OLED products. We have entered into only a limited number of such relationships from which most of our material sales and licensing revenue are generated. Our other relationships with product manufacturers currently are limited to technology development and the evaluation of our OLED technologies and materials for possible use in commercial products. Some or all of these relationships may not succeed or, even if they are successful, may not result in the product manufacturers entering into commercial licensing and material supply relationships with us.

Many of our agreements with product manufacturers last for only limited periods of time, such that our relationships with these manufacturers will expire unless they are renewed. These product manufacturers may not agree to renew their relationships with us on a continuing basis or may agree to do so on terms that are less favorable to us. In addition, we regularly continue working with product manufacturers after our existing agreements with them have expired while we are attempting to negotiate contract extensions or new agreements with them. Should our relationships with the various product manufacturers not continue or be renewed on less favorable terms, or if we are not able to identify other product manufacturers and enter into contracts with them, our business may materially suffer.

Our ability to enter into additional commercial licensing and material supply relationships, or to maintain our existing relationships, may depend on our ability to make certain financial or other commitments. We might not be able, for financial or other reasons, to enter into or continue these relationships on commercially acceptable terms, or at all. Failure to do so may cause our business strategy to fail.

If we fail to make advances in our OLED research and development activities, we might not succeed in commercializing our OLED technologies and materials.

Further advances in our OLED technologies and materials depend, in part, on the success of the research and development work we conduct, both alone and with our research partners. We cannot be certain that this work will yield additional advances in the research and development of these technologies and materials.

Our research and development efforts remain subject to all of the risks associated with the development of new products based on emerging and innovative technologies, including, without limitation, unanticipated technical or other problems and the possible insufficiency of funds for completing development of these products. Technical problems may result in delays and cause us to incur additional expenses that would increase our losses. If we cannot complete research and development of our OLED technologies and materials successfully, or if we experience delays in completing research and development of our OLED technologies and materials for use in potential commercial applications, particularly after incurring significant expenditures, our business may fail.

Conflicts or other problems may arise with our customers or joint development partners, resulting in renegotiation, breach or termination of, or litigation related to, our agreements with them. This would adversely affect our revenues.

Conflicts or other problems could arise between us and our customers or joint development partners, some of which we have made strategic investments in, as to royalty rates, milestone payments or other commercial terms. Similarly, we may disagree with our customers or joint development partners as to which party owns or has the right to commercialize intellectual property that is developed during the course of the relationship or as to other non-commercial terms. If such a conflict were to arise, a customer or joint development partner might attempt to compel renegotiation of certain terms of their agreement or terminate their agreement entirely, and we might lose the royalty revenues, material sales revenues and other benefits of the agreement. Either we or the customer or joint development partner might initiate litigation to determine commercial obligations, establish intellectual property rights or resolve other disputes under the agreement. Such litigation could be costly to us and require substantial attention of management. If we were unsuccessful in such litigation, we could lose the commercial benefits of the agreement, be liable for financial damages and suffer losses of intellectual property or other rights that are the subject of dispute.

If our OLED technologies and materials are not feasible for broad-based product applications, we may not be able to continue to generate revenues sufficient to support ongoing operations.

Our main business strategy is to license our OLED technologies and sell our OLED materials to manufacturers for incorporation into the display and lighting products that they sell. Consequently, our success depends on the ability and willingness of these manufacturers to develop, manufacture and sell commercial products integrating our technologies and materials.

Before product manufacturers will agree to expand the use of our OLED technologies and materials for wider scale commercial production, they will likely require us to demonstrate to their satisfaction that our OLED technologies and materials are feasible for broad-based product applications beyond current commercial application, such as smartphones, wearables and television displays. This, in turn, may require additional advances in our technologies and materials, as well as those of others, for applications in a number of areas, including, without limitation, advances with respect to the development of:

- OLED materials with improved lifetimes, efficiencies and color coordinates for larger area full-color OLED displays and general lighting products;
- more robust OLED materials for use in more demanding large-scale manufacturing environments; and
- scalable and cost-effective methods and technologies for the fabrication of large volume OLED materials and products.

We cannot be certain that these advances will occur, and hence our OLED technologies and materials may not be feasible for additional broad-based product applications and expansion.

Even if our OLED technologies are technically feasible, they may not be adopted by product manufacturers.

The potential size, timing and viability of market opportunities targeted by us are uncertain at this time. Market acceptance of our OLED technologies beyond current product offerings will depend, in part, upon these technologies providing benefits comparable or superior to current display and lighting technologies at an advantageous cost to manufacturers, and the adoption of products incorporating these technologies by consumers. Many current and potential customers for our OLED technologies utilize and have invested significant resources in competing technologies, and may, therefore, be reluctant to redesign their products or manufacturing processes to incorporate our OLED technologies.

During the entire product development process for a new product, we face the risk that our technology will fail to meet the manufacturer's technical, performance or cost requirements or will be replaced by a competing product or alternative technology. Even if we offer technologies that are satisfactory to a product manufacturer, the manufacturer may choose to delay or terminate its product development efforts for reasons unrelated to our technologies. In addition, our agreements with our customers do not require them to purchase our host materials in order to utilize our phosphorescent emitter materials, and those customers may elect not to purchase our host materials.

Mass production of new mass market OLED products will require the availability of suitable manufacturing equipment, components and materials, many of which are available only from a limited number of suppliers. In addition, there may be a number of other technologies that manufacturers need to utilize in conjunction with our OLED technologies in order to bring these new OLED products to the market. Thus, even if our OLED technologies are a viable alternative to competing approaches, if product manufacturers are unable to obtain access to this equipment and these components, materials and other technologies, they may not utilize our OLED technologies.

There are numerous potential alternatives to OLEDs, which may limit our ability to commercialize our OLED technologies and materials.

The flat panel display market is currently, and will likely continue to be for some time, dominated by displays based on LCD technology. Numerous companies are making substantial investments in, and conducting research to improve characteristics of, LCDs; additionally, other competing flat panel display technologies have been, or are being, developed. A similar situation exists in the solid-state lighting market, which is currently dominated by LED products. Advances in any of these various technologies may overcome their current limitations and permit them to become the leading technologies in their field, either of which could limit the potential market for products utilizing our OLED technologies and materials. This, in turn, would cause product manufacturers to avoid entering into commercial relationships with us, or to terminate or not renew their existing relationships with us.

Other OLED technologies may be more successful or cost-effective than ours, which may limit the commercial adoption of our OLED technologies and materials.

Our competitors have developed and continue to develop OLED technologies that differ from or compete with our OLED technologies. In particular, competing fluorescent and thermally activated delayed fluorescence OLED technology may become a viable alternative to our phosphorescent OLED technology. Moreover, our competitors may succeed in developing new OLED technologies that may become more cost-effective or have fewer limitations than our OLED technologies. If our OLED technologies, and particularly our phosphorescent OLED technology, are unable to capture a substantial portion of the OLED product market, our business strategy may fail.

The consumer electronics industry experiences significant downturns from time to time, any of which may adversely affect the demand for and pricing of our OLED technologies and materials.

Our success depends upon the ability and continuing willingness of our customers to manufacture and sell products utilizing our technologies and materials, specifically our phosphorescent emitters and host materials, and the widespread acceptance of our customers' products in the consumer marketplace. Any slowdown in the demand for our customers' products or a decrease in our customers' use of or demand for our materials would adversely affect our material sales and royalty revenues and thus our business. Our customers' decrease in the use of or demand for our materials may depend on several factors, including pricing, availability, continued technical improvements and competitive product offerings. The markets for flat panel displays and lighting products are highly competitive. Success in the market for end-user products that may integrate our OLED technologies and materials also depends on factors beyond the control of our customers and us, including the cyclical and seasonal nature of the end-user markets that our customers serve, as well as industry and general economic conditions.

The markets that we hope to penetrate have experienced significant periodic downturns, often in connection with, or in anticipation of, declines in general economic conditions. These downturns have been characterized by lower product demand, production overcapacity and erosion of average selling prices. Our business strategy is dependent on manufacturers building and selling products that incorporate our OLED technologies and materials. Industry-wide fluctuations and downturns in the demand for displays and solid-state lighting products could cause significant harm to our business.

Our customers may develop new or more efficient manufacturing processes, which may adversely affect demand for our OLED materials.

OLED device manufacturing is in its early stages. By developing enhanced material processing methods and more efficient manufacturing techniques, our customers who purchase our phosphorescent emitter and host materials could become more efficient in the utilization of our materials, which could limit or reduce the amount of materials they purchase from us. Thus, demand for our materials may not expand in proportion to the number of OLED related products manufactured by our customers, and may result in reduced demand for our materials and technology relative to our customers' manufacture and sale of products made with such materials.

Any downturn in U.S. or global economic conditions may have a significant adverse effect on our business.

There have been significant and sustained economic downturns in the U.S. and globally in the past. These downturns have placed pressure on consumer demand, and the resulting impact on consumer spending has had a material adverse effect on the demand for consumer electronic products. Similar downturns in the future may have a significant adverse effect on one or more of our licensees as an enterprise, which could result in those licensees reducing their efforts to commercialize products that incorporate our OLED technologies and materials. Consumer demand and the condition of the display and lighting industries may also be impacted by other external factors such as war, terrorism, geopolitical uncertainties and other business interruptions. The impact of these external factors is difficult to predict, and one or more of these factors could adversely impact the demand for our customers’ products, and thus our business.

Many of our competitors have greater resources, which may make it difficult for us to compete successfully against them.

The flat panel display and solid-state lighting industries are characterized by intense competition. Many of our competitors have better name recognition and greater financial, technical, marketing, personnel and research capabilities than we do. Because of these differences, we may never be able to compete successfully in these markets or maintain any competitive advantages we are able to achieve over time.

If we cannot keep our key employees or hire other talented persons as we grow, our business might not succeed.

Our performance is substantially dependent on the continued services of our executive officers and other key technical and managerial personnel, and on our ability to offer competitive salaries and benefits to these and our other employees. We do not have employment agreements with any of our executive officers or other key technical or managerial personnel. Additionally, competition for highly skilled technical and managerial personnel is intense. We might not be able to attract, hire, train, retain and motivate the highly skilled employees we need to be successful. If we fail to attract and retain the necessary technical and managerial personnel, our business will suffer and might fail.

We rely solely on PPG to manufacture the OLED materials we use and sell to product manufacturers.

Our business prospects depend significantly on our ability to obtain proprietary OLED materials for our own use and for sale to product manufacturers. Our agreement with PPG provides us with a source for these materials for development, evaluation and commercial purposes. Our agreement with PPG currently runs through the end of 2019

and shall be automatically renewed for additional one year terms, unless terminated by us with prior notice of one year or terminated by PPG with prior notice of two years. Our inability to continue obtaining these OLED materials from PPG or another source at cost-competitive prices and to continue obtaining these OLED materials in sufficient quantities to meet our product manufacturers' current and future demands and timetables would have a material adverse effect on our revenues and cost of goods sold relating to sales of these materials to OLED product manufacturers, as well as on our ability to perform future development work.

We strive to maintain sufficient levels of inventory to accommodate our manufacturing customers. Inventory management relating to our material sales is complex, and excess inventory may harm our business and cause it to suffer.

Inventory management remains an area of focus as we balance the need to maintain strategic inventory levels of our OLED materials to ensure competitive lead times against the risk of inventory obsolescence because of rapidly changing technology and customer requirements. As a just-in-time supplier to our customers, we carry sufficient inventory to accommodate their capacity

requirements, sometimes without firm purchase commitments. Our dependence on third-party manufacturers to provide our materials to us exposes us to longer lead times than if we were a direct manufacturer, increasing our risk of inventory obsolescence comparatively. Our customers may increase orders during periods of product shortages, cancel orders if their inventory is too high, or delay orders in anticipation of new products. They also may adjust their orders in response to the supply and demand of their products by end-users, or the supply and demand of our products and the products of our competitors that are available to them.

Inventory management risks are heightened when our largest customers launch new products and retire existing products. At such times, these customers tend to change product designs and may introduce some of our new materials into new designs. The production of these materials requires us to purchase essential raw material and commence manufacturing well in advance of receiving firm customer orders for such materials. Accordingly, we are subject to the risk of unanticipated changes in our customers' manufacturing plans and designs. Unanticipated product cessation and product introduction delays or cancellation may cause us to order or produce excess or insufficient inventory. Excess inventory of our OLED materials is subject to the risk of inventory obsolescence. In the event that a substantial portion of our inventory becomes obsolete, it could have a material adverse effect on earnings due to the resulting costs associated with the inventory impairment charges and inventory write downs.

We are the sole source supplier for certain critical components used in OLED technologies, which subjects customers to risk if we are unable to meet the demand for such components.

Our customers depend on us as the sole source for certain critical components used in manufacturing OLED products, which makes them susceptible to supply shortages if we are unable to meet their demand for such components. A potential customer could be hesitant to adopt OLED technology given the risks inherent in depending on a sole source for critical components and the inability to establish alternate supply relationships. If we are unable to supply the components needed by our existing customers in a timely manner, or if potential customers do not utilize OLED technology because of concerns about our ability to meet supply demands, our business may materially suffer.

We may require additional funding in the future in order to continue our business.

Our capital requirements have been and will continue to be significant. We may require additional funding in the future for the research, development and commercialization of our OLED technologies and materials, to obtain and maintain patents and other intellectual property rights in these technologies and materials, and for working capital and other purposes, the timing and amount of which are difficult to ascertain. Our cash on hand may not be sufficient to meet all of our future needs. When we need additional funds, such funds may not be available on commercially reasonable terms or at all. If we cannot obtain more money when needed, our business might fail. Additionally, if we attempt to raise money in an offering of shares of our common stock, preferred stock, warrants or depositary shares, or if we engage in acquisitions involving the issuance of such securities, the issuance of these shares will dilute our then-existing shareholders.

Because the vast majority of OLED product manufacturers are located in the Asia-Pacific region, we are subject to international operational, financial, legal and political risks which may negatively impact our operations.

Many of our customers and prospective customers have a majority of their operations in countries other than the United States, particularly in the Asia-Pacific region. We also have offices in various countries located outside of the United States. Risks associated with our doing business outside of the United States include, without limitation:

- compliance with a wide variety of foreign laws and regulations, including certain registration requirements for the OLED materials we sell;
- legal uncertainties regarding taxes, tariffs, quotas, export controls, export licenses and other trade barriers;
- economic instability in the countries of our customers, causing delays or reductions in orders for their products and therefore our royalties;

- political instability in the countries in which our customers operate, particularly in South Korea relating to its disputes with and proximity to North Korea and in Taiwan relating to its disputes with China;
- difficulties in collecting accounts receivable and longer accounts receivable payment cycles; and
- potentially adverse tax and tariff consequences.

Any of these factors could impair our ability to license our OLED technologies and sell our OLED materials, thereby harming our business. Compliance with changing laws and regulations may involve significant costs or require changes in business practice that could result in reduced profitability.

We rely on information technology systems to operate various elements of our business and a cyber-attack or other breach of our systems, or those of third parties on whom we may rely, could subject us to liability or interrupt the operation of our business.

We are dependent on information technology systems to operate various elements of our business. A breakdown, invasion, corruption, destruction or interruption of critical information technology systems by employees, others with authorized access to our systems or unauthorized persons could negatively impact operations. In the ordinary course of business, we collect, store and transmit important data and it is critical that we do so in a secure manner to maintain the confidentiality and integrity of such information. Additionally, we outsource certain elements of our information technology systems to third parties. As a result of this outsourcing, our third party vendors may or could have access to our confidential information making such systems vulnerable. Data breaches of our information technology systems, or those of our third party vendors, may pose a risk that sensitive data may be exposed to unauthorized persons or to the public. While we believe that we have taken appropriate security measures to protect our data and information technology systems, and have been informed by our third party vendors that they have as well, there can be no assurance that our efforts will prevent breakdowns or breaches in our systems, or those of our third party vendors, that could adversely affect our business.

The U.S. government has rights to intellectual property derived from our government-funded work that might prevent us from realizing the full benefits of our intellectual property portfolio.

The U.S. government, through various government agencies, has provided and continues to provide funding to us, Princeton, USC and Michigan for work related to certain aspects of our OLED technologies. Because we have been provided with this funding, the government has rights to any intellectual property derived from this work that could restrict our ability to market OLED products to the government for military and other applications, or to license this intellectual property to third parties for commercial applications. Moreover, if the government determines that we have not taken effective steps to achieve practical application of this intellectual property in any field of use in a reasonable time, the government could require us to license this intellectual property to other parties in that field of use. Any of these occurrences would limit our ability to obtain maximum value from our intellectual property portfolio.

The market price of our common stock may be highly volatile.

The market price of our common stock may be highly volatile, as has been the case with our common stock in the past as well as the securities of many companies, particularly other emerging-growth companies in the technology industry. We have included in the section of this report entitled “Market for Registrant’s Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities,” a table indicating the high and low closing prices of our common stock as reported on the NASDAQ Global Market for the past two years. Factors such as the following may have a significant impact on the market price of our common stock in the future:

- our revenues, expenses and operating results;
- announcements by us, by our customers, or our competitors of technological developments, new product applications or contractual arrangements;
- announcements relating to dividends and share repurchases; and
- other factors affecting the flat panel display and solid-state lighting industries in general.

Our operating results may have significant period-to-period fluctuations, which would make it difficult to predict our future performance.

Due to the current stage of commercialization of our OLED technologies and materials, the limited number of commercially successful consumer products utilizing our OLED technologies that customers have introduced in the marketplace, the relatively short product lifetimes of these consumer products, and the significant development and manufacturing objectives that we and our customers must achieve for the widespread inclusion of our OLED

technologies in consumer products such as tablets, television displays and lighting products, our quarterly operating results are difficult to predict and may vary significantly from quarter to quarter.

We believe that period-to-period comparisons of our operating results are not a reliable indicator of our future performance at this time. Among other factors affecting our period-to-period results, our license and technology development fees often consist of large one-time, annual or semi-annual payments, which may result in significant fluctuations in our revenues. In addition, our reliance on a small number of licensees with large volumes of consumer product sales makes our quarterly operating results subject to our licensee's specific plans and the success of their specific product offerings.

With respect to material sales, our sales are primarily dependent on purchases made by a small number of customers. In addition to the other factors described above relating to our customers' sales opportunities, our quarter-to-quarter sales may be materially impacted by our customers' inventory management plans, which may vary substantially based on financial management considerations, changes in their product mix plans, modified material processing techniques and manufacturing line modifications.

If, in some future period, our operating results or business outlook fall below the expectations of securities analysts or investors, our stock price would be likely to decline and investors in our common stock may not be able to resell their shares at or above their purchase price. Broad market, industry and global economic factors may also materially reduce the market price of our common stock, regardless of our operating performance.

The issuance of additional shares of our common stock could drive down the price of our stock.

The price of our common stock could decrease if:

- shares of our common stock that are currently subject to restriction on sale become freely salable, whether through an effective registration statement or based on Rule 144 under the Securities Act of 1933, as amended; or
- we issue additional shares of our common stock that might be or become freely salable, including shares that would be issued upon conversion of our preferred stock or the exercise of outstanding stock options.

We can issue shares of preferred stock that may adversely affect the rights of shareholders of our common stock.

Our Articles of Incorporation authorize us to issue up to 5,000,000 shares of preferred stock with designations, rights and preferences determined from time-to-time by our Board of Directors. Accordingly, our Board of Directors is empowered, without shareholder approval, to issue preferred stock with dividend, liquidation, conversion, voting or other rights superior to those of shareholders of our common stock. For example, an issuance of shares of preferred stock could:

- adversely affect the voting power of the shareholders of our common stock;
- make it more difficult for a third party to gain control of us;
- discourage bids for our common stock at a premium; or
- otherwise adversely affect the market price of our common stock.

As of February 21, 2019, we have issued and outstanding 200,000 shares of Series A Nonconvertible Preferred Stock, all of which are held by an entity controlled by members of the family of Sherwin I. Seligsohn, our Founder and Chairman of the Board of Directors. Our Board of Directors has authorized and issued other shares of preferred stock in the past, none of which are currently outstanding, and may do so again at any time in the future.

Any decisions to reduce or discontinue paying cash dividends to our shareholders could cause the market price for our common stock to decline.

In 2017, our Board of Directors declared quarterly cash dividends on our common stock, and we intend to pay regular quarterly dividends in the future. However, payment of future cash dividends will be at the discretion of our Board of Directors and will depend upon our results of operations, earnings, capital requirements, contractual restrictions and other factors deemed relevant by our Board of Directors. As such, we may modify, suspend or cancel our cash dividend policy in any manner and at any time. Any reduction or discontinuance by us of the payment of quarterly cash dividends could cause the market price of our common stock to decline. Moreover, in the event our payment of quarterly cash dividends are reduced or discontinued, our failure or inability to resume paying cash dividends at historical levels could cause the market price of our common stock to decline. There is no guarantee that our common stock will appreciate in value or even maintain the price at which current shareholders purchased their shares.

Our executive officers and directors own a significant percentage of our common stock and could exert significant influence over matters requiring shareholder approval, including takeover attempts.

Our executive officers and directors and their respective affiliates and the adult children of Sherwin Seligsohn, beneficially own, as of February 21, 2019, approximately 10.1% of the outstanding shares of our common stock. Accordingly, these individuals may, as a practical matter, be able to exert significant influence over matters requiring approval by our shareholders, including the election of directors and the approval of mergers or other business combinations. This concentration also could have the effect of delaying or preventing a change in control of us.

Natural disasters or other unforeseen catastrophic events could unfavorably affect our business.

Natural disasters, such as hurricanes, tsunamis, or earthquakes, particularly in Asia-Pacific region, where many of our customers are located, or the occurrence of other unforeseen catastrophic events, such a fire or flood, could unfavorably affect our business and financial performance. Such events could unfavorably affect our customers in many ways, such as causing physical damage to one or more of their properties, the temporary or permanent closure of one or more plants, the disruption or cessation of manufacturing of product lines, and the temporary or long-term disruption in the supply or demand for their products. A resulting by-product of such natural disasters or other unforeseen catastrophic events could be a temporary or long-term disruption in the supply of or demand for our products.

Our effective tax rate may increase or decrease.

We are subject to income taxes in the U.S. and numerous foreign jurisdictions. Significant judgment is required in determining our worldwide provision for income taxes. In the ordinary course of our business, there are many transactions and calculations where the ultimate tax determination is uncertain. We are subject to audit by tax authorities where we do business. Although we believe that our tax estimates and tax positions are reasonable, they could be materially affected by many factors including the final outcome of tax audits and related litigation, the introduction of new tax accounting standards, legislation, regulations, and related interpretations, our global mix of earnings and the realizability of deferred tax assets. An increase or decrease in our effective tax rate could have a material adverse impact on our financial condition and results of operations.

In addition, at any time, U.S. federal tax laws or the administrative interpretations of those laws may be changed. In December 2017, the legislation commonly referred to as the Tax Cuts and Jobs Act, which made widespread changes to the Internal Revenue Code, was signed into law. While we believe that this law generally will have a favorable effect on U.S. corporations and their shareholders, uncertainty remains regarding the full effect that this law will have on us, particularly given the global nature of our operations, or the impact on our customers, vendors, shareholders and other stakeholders. We also cannot predict whether, when or to what extent other new U.S. federal tax laws, regulations, interpretations or rulings will be issued. As a result, changes in U.S. federal tax laws could negatively impact our operating results, financial condition and business operations, and adversely impact our shareholders.

Occasionally, changes in state and local tax laws or regulations are enacted that may result in an increase in our tax liability. Shortfalls in tax revenues for states and municipalities in recent years may lead to an increase in the frequency and size of such changes. If such changes occur, we may be required to pay additional taxes on our assets or income.

ITEM 1B. UNRESOLVED STAFF COMMENTS

None.

ITEM 2. PROPERTIES

Our corporate offices and research and development laboratories are located at 375 Phillips Boulevard in Ewing, New Jersey. In 2004, we acquired the building and property at which this facility is located. During 2005, we conducted a two-stage expansion of our laboratory and office space in the building, as well as a recent expansion in 2013 and 2015. We currently occupy the entire newly expanded facility. In 2017, we acquired the building and property at which the Adesis facility is located at 27 McCullough Drive in New Castle, Delaware.

ITEM 3. LEGAL PROCEEDINGS

Patent Related Challenges and Oppositions

Each major jurisdiction in the world that issues patents provides both third parties and applicants an opportunity to seek a further review of an issued patent. The process for requesting and considering such reviews is specific to the

jurisdiction that issued the patent in question, and generally does not provide for claims of monetary damages or a review of specific claims of infringement. The conclusions made by the reviewing administrative bodies tend to be appealable and generally are limited in scope and applicability to the specific claims and jurisdiction in question.

We believe that opposition proceedings are frequently commenced in the ordinary course of business by third parties who may believe that one or more claims in a patent do not comply with the technical or legal requirements of the specific jurisdiction in which the patent was issued. We view these proceedings as reflective of our goal of obtaining the broadest legally permissible patent coverage permitted in each jurisdiction. Once a proceeding is initiated, as a general matter, the issued patent continues to be presumed valid until the jurisdiction's applicable administrative body issues a final non-appealable decision. Depending on the jurisdiction, the outcome of these proceedings could include affirmation, denial or modification of some or all of the originally issued claims. We believe that as OLED technology becomes more established and as our patent portfolio increases in size, so will the number of these proceedings.

Below are summaries of certain active proceedings that have been commenced against issued patents that are either exclusively licensed to us or which are now assigned to us. We do not believe that the confirmation, loss or modification of our rights in any individual claim or set of claims that are the subject of the following legal proceedings would have a material impact on our materials sales or licensing business or on our consolidated financial statements, including our consolidated statements of income, as a whole. However, as noted within the descriptions, some of the following proceedings involve issued patents that relate to our fundamental phosphorescent OLED technologies and we intend to vigorously defend against claims that, in our opinion, seek to restrict or reduce the scope of the originally issued claim, which may require the expenditure of significant amounts of our resources. In certain circumstances, when permitted, we may also utilize the proceedings to request modification of the claims to better distinguish the patented invention from any newly identified prior art and/or improve the claim scope of the patent relative to commercially important categories of the invention. The entries marked with an "*" relate to our UniversalPHOLED® phosphorescent OLED technology, some of which may be commercialized by us.

Opposition to European Patent No. 1390962

On November 16, 2011, Osram AG and BASF SE each filed a Notice of Opposition to European Patent No. 1390962 (the EP '962 patent), which relates to our white phosphorescent OLED technology. The EP '962 patent, which was issued on February 16, 2011, is a European counterpart patent to U.S. patents 7,009,338 and 7,285,907. They are exclusively licensed to us by Princeton, and we are required to pay all legal costs and fees associated with this proceeding.

The EPO combined the oppositions into a single opposition proceeding, and a hearing was held in December 2015, wherein the EPO Opposition Division revoked the patent claims for alleged insufficiencies under EPC Article 83. We believe the EPO's decision relating to the original claims is erroneous, and we have appealed the decision. Subsequent to the filing of the appeal, BASF withdrew its opposition to the patent. This patent, as originally granted by the EPO, is deemed valid during the pendency of the appeals process.

At this time, based on our current knowledge, we believe that the patent being challenged should be declared valid and that all or a significant portion of our claims should be upheld. However, we cannot make any assurances of this result.

Opposition to European Patent No. 1933395*

On February 24 and 27, 2012, Sumitomo, Merck Patent GmbH and BASF SE filed oppositions to our European Patent No. 1933395 (the EP '395 patent). The EP ‘395 patent is a counterpart patent to the EP ‘637 patent, and, in part, to the U.S. Patents 7,001,536; 6,902,830; and 6,830,828 and to JP patents 4358168 and 4357781. This patent is exclusively licensed to us by Princeton, and we are required to pay all legal costs and fees associated with this proceeding.

At an Oral Hearing on October 14, 2013, the EPO panel issued a decision that affirmed the basic invention and broad patent coverage in the EP '395 patent, but narrowed the scope of the original claims.

On February 26, 2014, we appealed the ruling to reinstate a broader set of claims. The patent, as originally granted by the EPO, is deemed to be valid during the pendency of the appeals process. Two of the three opponents also filed their own appeals of the ruling. In January 2015, Sumitomo withdrew its opposition of the '395 patent, and the EPO accepted the withdrawal notice. The appeal proceedings were held in the second quarter of 2016. As a result of the proceedings, the board concluded the oral proceedings and proposed to reinstate a broader set of claims pending the resolution of a remaining question of the applicable law, a question that the board has deferred to the Enlarged Board of Appeals for review. In December 2017, the Enlarged Board of Appeals issued a written opinion in which they have generally followed our reasoning regarding the question of law. The written opinion should be used as guidance by the EPO opposition panel when the oral proceedings are rescheduled. The originally-granted claims remain in force during the pendency of this process.

In addition to the above proceedings and now concluded proceedings which have been referenced in prior filings, from time to time, we may have other proceedings that are pending which relate to patents we acquired as part of the Fujifilm patent or BASF OLED patent acquisitions or which relate to technologies that are not currently widely utilized in the marketplace.

EXECUTIVE OFFICERS OF THE REGISTRANT

The following table sets forth certain information with respect to our executive officers as of February 21, 2019:

Name	Age	Position
Sherwin I. Seligsohn	83	Founder and Chairman of the Board of Directors
Steven V. Abramson	67	President, Chief Executive Officer and Director
Sidney D. Rosenblatt	71	Executive Vice President, Chief Financial Officer, Treasurer, Secretary and Director
Julia J. Brown	57	Senior Vice President and Chief Technical Officer
Janice M. DuFour	61	Vice President of Technology Commercialization and General Manager, PHOLED Material Sales Business
Mauro Premutico	53	Vice President, Legal and General Manager, Patents and Licensing

Our Board of Directors has appointed these executive officers to hold office until their successors are duly appointed.

Sherwin I. Seligsohn is our Founder and has been the Chairman of our Board of Directors since June 1995. He also served as our Chief Executive Officer from June 1995 through December 2007, and as our President from June 1995 through May 1996. Mr. Seligsohn serves as the sole Director, President and Secretary of American Biomimetics Corporation, International Multi-Media Corporation, and Wireless Unified Network Systems Corporation. He was also previously the Chairman of the Board of Directors, President and Chief Executive Officer of NanoFlex Power Corporation (formally known as Global Photonic Energy Corporation) (NanoFlex) until April 2012, when he resigned from his positions at NanoFlex. Since that time, Mr. Seligsohn's only relationship with NanoFlex is as a shareholder and option holder. From June 1990 to October 1991, Mr. Seligsohn was Chairman Emeritus of InterDigital Communications, Inc. (InterDigital), formerly International Mobile Machines Corporation. He founded InterDigital and from August 1972 to June 1990 served as its Chairman of the Board of Directors. Mr. Seligsohn is a member of the Industrial Advisory Board of the Princeton Institute for the Science and Technology of Materials (PRISM) at Princeton.

Steven V. Abramson is our President and Chief Executive Officer, and has been a member of our Board of Directors since May 1996. Mr. Abramson served as our President and Chief Operating Officer from May 1996 through December 2007. From March 1992 to May 1996, Mr. Abramson was Vice President, General Counsel, Secretary and Treasurer of Roy F. Weston, Inc., a worldwide environmental consulting and engineering firm. From December 1982 to December 1991, Mr. Abramson held various positions at InterDigital, including General Counsel, Executive Vice President and General Manager of the Technology Licensing Division.

Sidney D. Rosenblatt is an Executive Vice President and has been our Chief Financial Officer, Treasurer and Secretary since June 1995. He also has been a member of our Board of Directors since May 1996. Mr. Rosenblatt was the owner of S. Zitner Company from August 1990 through August 2010 and served as its President from August 1990 through December 1998. From May 1982 to August 1990, Mr. Rosenblatt served as the Senior Vice President, Chief Financial Officer and Treasurer of InterDigital. Mr. Rosenblatt is on the Board of Managers of the Overbrook School for the Blind.

Julia J. Brown, Ph.D. is a Senior Vice President and has been our Chief Technical Officer since June 2002. She joined us in June 1998 as our Vice President of Technology Development. From 1991 to 1998, Dr. Brown was a Research Department Manager at Hughes Research Laboratories where she directed the pilot line production of high-speed Indium Phosphide-based integrated circuits for insertion into advanced airborne radar and satellite communication systems. Dr. Brown received an M.S. and Ph.D. in Electrical Engineering/Electrophysics at USC and a B.S.E.E. from

Cornell University. Dr. Brown is an elected Fellow of both the IEEE and the SID.

Janice M. DuFour has been our Vice President of Technology Commercialization since January 1997, and became the General Manager of our PHOLED Material Sales Business in January 2007. From 1992 to 1996, Ms. DuFour was Vice President of SAGE Electrochromics, Inc., a thin-film electrochromic technology company, where she oversaw a variety of business development, marketing and finance and administrative activities. From 1984 to 1989, Ms. DuFour was a Vice President and General Manager for Chronar Corporation, a leading developer and manufacturer of amorphous silicon photovoltaic (PV) panels. Prior to that, Ms. DuFour worked as Senior Engineer for the Industrial Chemicals Division of FMC Corporation. Ms. DuFour received her B.S. in Chemical Engineering from Rensselaer Polytechnic Institute in 1979, and an M.B.A. from Harvard University in 1984. Ms. DuFour was a member of the Technical Council of the FlexTech Alliance from 1997 through 2010, and a member of its Governing Board from 2008 through 2010. Ms. DuFour was a member of the Board of Directors and Marketing Committee Chairperson of the OLED Association from 2009-2014.

Mauro Premutico has been our Vice President of Legal and General Manager of Patents and Licensing since April 2012. Prior to joining us, Mr. Premutico was the Managing Vice President and Chief Patent Counsel for The Walt Disney Company from 2009 to 2012, and Vice President of Intellectual Property and Associate General Counsel for Lenovo Group Ltd. from 2005 to 2009. Mr.

Premutico was also Special Counsel at the law firm of Cleary, Gottlieb, Steen & Hamilton from 2002 until 2005 where he served as the co-head of the New York's office Intellectual Property and Technology Law practice. Mr. Premutico received a J.D. from Boston University School of Law, an M.B.A. from Yale University and a B.S.E.E. from Worcester Polytechnic Institute.

ITEM 4. MINE SAFETY DISCLOSURES

Not applicable.

PART II

ITEM 5. MARKET FOR REGISTRANT'S COMMON EQUITY, RELATED STOCKHOLDER MATTERS AND ISSUER PURCHASES OF EQUITY SECURITIES

Our Common Stock

Our common stock is quoted on the NASDAQ Global Market under the symbol "OLED." As of February 21, 2019, there were approximately 302 holders of record of our common stock.

During 2017 and 2018, we declared and paid cash dividends on our common stock. While we intend to pay regular quarterly dividends in the future, payment of future cash dividends will be at the discretion of our Board of Directors and will depend upon our results of operations, earnings, capital requirements, contractual restrictions and other factors deemed relevant by our Board of Directors. As such, we may modify, suspend or cancel our cash dividend policy in any manner and at any time.

Share Repurchases

During the quarter ended December 31, 2018, we acquired 193 shares of common stock through transactions related to the vesting of restricted share awards previously granted to employees of ours. Upon vesting, the employees turned in shares of common stock in amounts sufficient to pay the minimum statutory tax withholding at rates required by the relevant tax authorities.

The following table provides information relating to the shares we acquired during the fourth quarter of 2018 (dollar amounts in thousands, other than per share amounts):

Period	Total Number of Shares Purchased	Weighted Average Price Paid per Share	Total Number of Shares Purchased as Part of Publicly Announced Program	Approximate Dollar Value of Shares that May Yet Be Purchased Under the Program
October 1 – October 31	134	123.84	—	$ —
November 1 – November 30	36	98.00	—	—
December 1 – December 31	23	96.01	—	—
Total	193	—	—	—

Performance Graph

The performance graph below compares the change in the cumulative shareholder return of our common stock from December 31, 2013 to December 31, 2018, with the percentage change in the cumulative total return over the same period on (i) the Russell 2000 Index, and (ii) the Nasdaq Electronics Components Index. This performance graph assumes an initial investment of $100 on December 31, 2013 in each of our common stock, the Russell 2000 Index and the Nasdaq Electronics Components Index.

	Cumulative Total Return					
	12/13	12/14	12/15	12/16	12/17	12/18
Universal Display Corp.	100.00	80.76	158.44	163.85	502.98	273.20
Russell 2000	100.00	104.89	100.26	121.63	139.44	124.09
NASDAQ Electronic Components	100.00	133.28	130.82	169.00	240.33	213.45

Securities Authorized for Issuance under Equity Compensation Plans

The information required by this item with respect to our equity compensation plans will be set forth in our Proxy Statement, and is incorporated herein by reference.

ITEM 6. SELECTED FINANCIAL DATA

The following selected consolidated financial data has been derived from, and should be read in conjunction with, our Consolidated Financial Statements and the notes thereto, and with "Management's Discussion and Analysis of Financial Condition and Results of Operations," included elsewhere in this report.

(in thousands, except share and per share data)	Year Ended December 31,				
	2018	2017	2016	2015	2014
Operating Results:					
Total revenue	$247,414	$335,629	$198,886	$191,046	$191,031
Cost of sales (1)(2)	53,541	54,698	26,288	62,997	41,315
Research and development expense	53,717	49,144	42,744	44,641	41,154
Selling, general and administrative expense	46,999	46,808	32,876	29,046	28,135
Amortization of acquired technology and other intangible assets	21,962	21,983	16,493	10,999	10,997
Patent costs	7,464	7,010	6,249	5,717	6,291
Interest income, net	7,659	3,294	2,113	783	707
Income tax expense	(5,471)	(45,652)	(20,528)	(18,381)	(17,473)
Net income	58,840	103,885	48,070	14,678	41,854
Net income per common share, basic	$1.24	$2.19	$1.02	$0.31	$0.90
Net income per common share, diluted	$1.24	$2.18	$1.02	$0.31	$0.90
Balance Sheet Data:					
Total assets	$933,424	$779,956	$627,559	$559,412	$489,847
Current liabilities	133,182	63,824	40,206	34,510	26,823
Shareholders' equity	690,506	659,054	528,468	466,765	448,742
Other Financial Data:					
Working capital	$501,658	$455,358	$345,164	$413,174	$343,682
Capital expenditures	25,391	29,803	7,300	5,103	6,153
Purchase of intangibles	—	—	95,989	—	—
Weighted average shares used in computing basic net income per common share	46,849,588	46,725,289	46,408,460	46,816,394	46,252,960
Weighted average shares used in computing diluted net income per common share	46,896,766	46,805,194	46,535,980	47,494,188	46,685,145
Shares of common stock outstanding, end of period	47,319,887	47,118,171	46,913,127	46,774,360	45,703,963

(1) During the year ended December 31, 2018, a write-down in net realizable value of our inventory of $3.6 million was recorded due to lower than anticipated customer demand.

(2) During the second quarter of 2015, the Company experienced a faster-than-anticipated decline in host material sales, which we believe was a result of our customer's selling new products that did not include our host materials. Based on the most recent sales forecast, we determined that there were likely to be significantly lower sales of our existing host material. As such, a write-down in net realizable value of our inventory of $33.0 million during the

second quarter of 2015 was required.

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ITEM 7.MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

The following discussion and analysis of our financial condition and results of operations should be read in conjunction with the section entitled "Selected Financial Data" in this report and our Consolidated Financial Statements and related notes to this report. This discussion and analysis contains forward-looking statements based on our current expectations, assumptions, estimates and projections. These forward-looking statements involve risks and uncertainties. Our actual results could differ materially from those indicated in these forward-looking statements as a result of certain factors, as more fully discussed in Item 1A of this report, entitled "Risk Factors."

OVERVIEW

We are a leader in the research, development and commercialization of organic light emitting diode, or OLED, technologies and materials for use in displays for mobile phones, televisions, tablets, wearables, portable media devices, notebook computers, personal computers, and automotive applications, as well as specialty and general lighting products. Since 1994, we have been exclusively engaged, and expect to continue to be primarily engaged, in funding and performing research and development activities relating to OLED technologies and materials, and commercializing these technologies and materials. We derive our revenue primarily from the following:

- sales of OLED materials for evaluation, development and commercial manufacturing;
- intellectual property and technology licensing;
- contract research services in the areas of organic and organometallic materials synthesis research, development and commercialization; and
- technology development and support, including government contract work and support provided to third parties for commercialization of their OLED products.

Material sales relate to our sale of OLED materials for incorporation into our customers' commercial OLED products or for their OLED development and evaluation activities. Material sales are recognized at the time title passes, which is typically at the time of shipment or at the time of delivery, depending upon the contractual agreement between the parties.

We receive license and royalty payments under certain commercial, development and technology evaluation agreements, some of which are non-refundable advances. These payments may include royalty and license fees made pursuant to license agreements and also license fees included as part of certain commercial supply agreements. These payments are included in the estimate of total contract consideration by customer and recognized as revenue over the contract term based on material units sold at the estimated per unit fee over the life of the contract.

In 2018, the Company entered into a commercial license agreement with Samsung Display Co., Ltd. (SDC). This agreement, which covers the manufacture and sale of specified OLED display materials, was effective as of January 1, 2018 and lasts through the end of 2022 with an additional two-year extension option. Under this agreement, the Company is being paid a license fee, payable in quarterly installments over the agreement term of five years. The agreement conveys to SDC the non-exclusive right to use certain of the Company's intellectual property assets for a limited period of time that is less than the estimated life of the assets.

At the same time the Company entered into the current patent license agreement with SDC, the Company also entered into a new supplemental material purchase agreement with SDC. Under the current supplemental material purchase agreement, SDC agrees to purchase from the Company a minimum amount of phosphorescent emitter materials for use in the manufacture of licensed products. This minimum commitment is subject to SDC's requirements for phosphorescent emitter materials and the Company's ability to meet these requirements over the term of the supplemental agreement.

In 2015, the Company entered into an OLED patent license agreement and an OLED commercial supply agreement with LG Display Co., Ltd. (LG Display) which were effective as of January 1, 2015 and superseded the existing 2007

commercial supply agreement between the parties. The new agreements have a term that is set to expire by the end of 2022. The patent license agreement provides LG Display a non-exclusive, royalty bearing portfolio license to make and sell OLED displays under the Company's patent portfolio. The patent license calls for license fees, prepaid royalties and running royalties on licensed products. The agreements include customary provisions relating to warranties, indemnities, confidentiality, assignability and business terms. The agreements provide for certain other minimum obligations relating to the volume of material sales anticipated over the life of the agreements as well as minimum royalty revenue to be generated under the patent license agreement. The Company expects to generate revenue under these agreements that are predominantly tied to LG Display’s sales of OLED licensed products. The OLED commercial supply agreement provides for the sale of materials for use by LG Display, which may include phosphorescent emitters and host materials.

In 2016, the Company entered into long-term, multi-year OLED patent license and material purchase agreements with Tianma Micro-electronics Co., Ltd. (Tianma). Under the license agreement, the Company has granted Tianma non-exclusive license rights under various patents owned or controlled by the Company to manufacture and sell OLED display products. The license agreement calls for license fees and running royalties on licensed products. Additionally, the Company expects to supply phosphorescent OLED materials to Tianma for use in its licensed products.

In 2017, the Company entered into long-term, multi-year agreements with BOE Technology Group Co., Ltd. (BOE). Under these agreements, the Company has granted BOE non-exclusive license rights under various patents owned or controlled by the Company to manufacture and sell OLED display products. The Company has also agreed to supply phosphorescent OLED materials to BOE.

In 2018, the Company entered into long-term, multi-year OLED patent license and material purchase agreements with Visionox Technology, Inc. (Visionox). Under the license agreement, the Company has granted Visionox non-exclusive license rights under various patents owned or controlled by the Company to manufacture and sell OLED display products. The license agreement calls for license fees and running royalties on licensed products. Additionally, the Company expects to supply phosphorescent OLED materials to Visionox for use in its licensed products.

In 2016, we acquired Adesis, Inc. (Adesis) with operations in New Castle, Delaware. Adesis is a contract research organization (CRO) that provides support services to the OLED, pharma, biotech, catalysis and other industries. As of December 31, 2018, Adesis employed a team of 84 research scientists, chemists, engineers and laboratory technicians. Prior to our acquisition in 2016, we utilized more than 50% of Adesis' technology service and production output. We continue to utilize a significant portion of its technology research capacity for the benefit of our OLED technology development, and Adesis uses the remaining capacity to operate as a CRO in the above-mentioned industries providing contract research services to those third party customers. Contract research services is revenue earned by performing organic and organometallic synthetics research, development and commercialization on a contractual basis for our customers.

We also generate technology development and support revenue earned from government contracts, development and technology evaluation agreements and commercialization assistance fees, which include reimbursements by government entities for all or a portion of the research and development costs we incur in relation to our government contracts. Revenues are recognized as services are performed, proportionally as research and development costs are incurred, or as defined milestones are achieved.

We anticipate fluctuations in our annual and quarterly results of operations due to uncertainty regarding, among other factors:

- the timing, cost and volume of sales of our OLED materials;
- the timing of our receipt of license fees and royalties, as well as fees for future technology development and evaluation;
- the timing and magnitude of expenditures we may incur in connection with our ongoing research and development and patent-related activities; and
- the timing and financial consequences of our formation of new business relationships and alliances.

Critical Accounting Policies and Estimates

The discussion and analysis of our financial condition and results of operations is based on our consolidated financial statements, which have been prepared in accordance with U.S. generally accepted accounting principles. The preparation of these financial statements requires us to make estimates and judgments that affect our reported assets and liabilities, revenues and expenses, and other financial information. Actual results may differ significantly from our estimates under other assumptions and conditions.

We believe that our accounting policies related to revenue recognition and deferred revenue, inventories and income taxes, as described below, are our “critical accounting policies” as contemplated by the SEC. These policies, which have been reviewed with our Audit Committee, are discussed in greater detail below.

Revenue Recognition and Deferred Revenue

Material sales relate to the Company’s sale of its OLED materials for incorporation into its customers’ commercial OLED products or for their OLED development and evaluation activities. Material sales are recognized at the time title passes, which is typically at the time of shipment or at the time of delivery, depending upon the contractual agreement between the parties.

The rights and benefits to the Company's OLED technology are conveyed to the customer through technology license agreements and material supply agreements. These agreements are combined and the licenses and materials sold under these combined agreements are not distinct from each other for financial reporting purposes and as such, are accounted for as a single performance obligation. Accordingly, total contract consideration is estimated and recognized over the contract term based on material units sold during the period at their estimated per unit fee. Total contract consideration includes fixed amounts designated in contracts with customers as license fees as well as estimates of material fees and royalties to be earned.

Various estimates are relied upon to recognize revenue. The Company estimates total material units to be purchased by its customers over the contract term based on historical trends, industry estimates and its forecast process and related amounts to be charged. Additionally, management estimates the total sales-based royalties based on the estimated net sales revenue of its customers over the contract term.

Contract research services revenue is revenue earned by Adesis through performing organic and organometallic synthetics research, development and commercialization on a contractual basis. These services range from intermediates for structure-activity relationship studies, reference agents and building blocks for combinatorial synthesis, re-synthesis of key intermediates, specialty organic chemistry needs, and selective toll manufacturing. These services are provided to third-party pharmaceutical and life sciences firms and other technology firms at fixed costs or on an annual contract basis. Revenue is recognized as services are performed with billing schedules and payment terms negotiated on a contract-by-contract basis. Payments received in excess of revenue recognized are recorded as deferred revenue. In other cases, services may be provided and revenue is recognized before the client is invoiced. In these cases, revenue recognized will exceed amounts billed and the difference, representing amounts which are currently unbillable to the customer pursuant to contractual terms, is recorded as an unbilled receivable.

Technology development and support revenue is revenue earned from government contracts, development and technology evaluation agreements and commercialization assistance fees, which includes reimbursements by government entities for all or a portion of the research and development costs the Company incurs in relation to its government contracts. Revenues are recognized proportionally as research and development costs are incurred, or as defined milestones are achieved, and are included in contract research services in the accompanying consolidated statements of income.

The Company records taxes billed to customers and remitted to various governmental entities on a gross basis in both revenues and cost of material sales in the consolidated statements of income. The amounts of these pass-through taxes reflected in revenues and cost of material sales were $117,000, $409,000, and $171,000 in the years ended December 31, 2018, 2017 and 2016, respectively.

Inventories

Inventories consist of raw materials, work-in-process and finished goods, and are stated at the lower of cost, determined on a first-in, first-out basis, or net realizable value. Inventory valuation and firm committed purchase order assessments are performed on a quarterly basis and those items that are identified to be obsolete or in excess of forecasted usage are written down to their estimated realizable value. Estimates of realizable value are based upon management's analyses and assumptions, including, but not limited to, forecasted sales levels by product, expected product lifecycle, product development plans and future demand requirements. A 12-month rolling forecast based on factors, including, but not limited to, production cycles, anticipated product orders, marketing forecasts, backlog, and shipment activities is used in the inventory analysis. If market conditions are less favorable than forecasts or actual demand from customers is lower than estimates, additional inventory write-downs may be required. If demand is higher than expected, inventories that had previously been written down may be sold.

Accounting for Income Taxes

We are subject to income taxes in both the U.S. and foreign jurisdictions. Significant judgments and estimates are required in evaluating our tax positions for future realization and determining our provision for income taxes. Our income tax expense, deferred tax assets and liabilities, and reserves for unrecognized tax benefits reflect management's best assessment of estimated future taxes to be paid.

In assessing the realizability of deferred tax assets, we consider whether it is more likely than not that some portion or all of our deferred tax assets will not be realized. The ultimate realization of deferred tax assets is dependent on our ability to generate future taxable income to obtain benefit from the reversal of temporary differences, net operating loss carryforwards and tax credits. As part of our assessment we consider the scheduled reversal of deferred tax assets and liabilities, projected future taxable income, and tax planning strategies.

During the year ended December 31, 2018, based on previous earnings history, a current evaluation of expected future taxable income and other evidence, we determined to retain the valuation allowance that relates to New Jersey research and development credits. Actual results could differ from our assessments if adequate taxable income is generated in future periods. To the extent we establish a new valuation allowance or change a previously established valuation allowance in a future period, income tax expense will be impacted.

RESULTS OF OPERATIONS

Comparison of the Years Ended December 31, 2018 and 2017

	Year Ended December 31,		(Decrease) Increase
	2018	2017	
REVENUE	$247,414	$335,629	$ (88,215)
COST OF SALES	53,541	54,698	(1,157)
Gross margin	193,873	280,931	(87,058)
OPERATING EXPENSES:			
Research and development	53,717	49,144	4,573
Selling, general and administrative	46,999	46,808	191
Amortization of acquired technology and other intangible assets	21,962	21,983	(21)
Patent costs	7,464	7,010	454
Royalty and license expense	6,996	9,739	(2,743)
Total operating expenses	137,138	134,684	2,454
OPERATING INCOME	56,735	146,247	(89,512)
Interest income, net	7,659	3,294	4,365
Other expense, net	(83)	(4)	(79)
Interest and other expense, net	7,576	3,290	4,286
INCOME BEFORE INCOME TAXES	64,311	149,537	(85,226)
INCOME TAX EXPENSE	(5,471)	(45,652)	40,181
NET INCOME	$58,840	$103,885	$ (45,045)

Revenue

During the year ended December 31, 2018, we recognized revenue of $247.4 million, a decrease of $88.2 million from the year ended December 31, 2017. The decrease in revenue was primarily the result of the impact of Accounting Standards Codification (“ASC”) Topic 606 and lower material sales. Revenue for the year ended December 31, 2018 was $78.9 million lower than what would have been recorded under ASC 605. Under ASC 606, we recognize license fee revenue on a material units sold basis in contrast to our recognizing license fee revenue either upon a straight-line basis or upon receipt of payment that was required under ASC 605. The decrease in revenue was also the result of near-term weakness in the mobile display segment of the OLED display market that primarily impacted our first quarter results. Despite the near-term weakness in this segment, we believe the overall OLED display market will continue to grow as expected.

Revenue derived from OLED sales comprised 95% of total revenue for the year ended December 31, 2018 as compared to 97% for the year ended December 31, 2017. The remaining portion of our revenue was derived from contract research services. Contract research services include revenue earned by our subsidiary, Adesis, which performs organic and organometallic synthetics research, development and commercialization on a contractual basis for our customers.

Cost of Sales

Cost of sales for the year ended December 31, 2018 decreased by $1.2 million as compared to the year ended December 31, 2017 primarily due to the decline in the level of material sales. Included in the cost of sales for the year

ended December 31, 2018 was an excess and obsolete inventory charge of $3.6 million due to lower than anticipated customer demand. As a result of the impact of ASC 606 and the decline in material sales, gross margin for the year ended December 31, 2018 decreased by $87.1 million as compared to the year ended December 31, 2017 with gross margin as a percentage of sales decreasing to 78% from 84%, respectively.

Research and development

Research and development expenses increased to $53.7 million for the year ended December 31, 2018, as compared to $49.1 million for the year ended December 31, 2017. The increase in research and development expenses was primarily due to higher operating costs, including increased contract research activity.

Selling, general and administrative

Selling, general and administrative expenses increased to $47.0 million for the year ended December 31, 2018, as compared to $46.8 million for the year ended December 31, 2017. The increase in selling, general and administrative expenses was primarily due to higher employee-related compensation expenses.

Amortization of acquired technology and other intangible assets

Amortization of acquired technology and other intangible assets was $22.0 million for both of the years ended December 31, 2018 and 2017. See Note 8 in Notes to Consolidated Financial Statements for further discussion.

Patent costs

Patent costs increased to $7.5 million for the year ended December 31, 2018, as compared to $7.0 million for the year ended December 31, 2017.

Royalty and license expense

Royalty and license expense decreased to $7.0 million for the year ended December 31, 2018, as compared to $9.7 million for the year ended December 31, 2017. The decrease was due to decreased royalties incurred under our amended license agreement with Princeton, USC, and Michigan, resulting from a decrease in qualifying material sales. See Note 10 in Notes to Consolidated Financial Statements for further discussion.

Interest income, net and other expense, net

Interest income, net was $7.7 million for the year ended December 31, 2018, as compared to $3.3 million for the year ended December 31, 2017. The increase in interest income, net was primarily due to the increase in available-for-sale investments held during the year ended December 31, 2018 over amounts held in the comparable period in 2017. Other expense, net primarily consisted of net exchange gains and losses on foreign currency transactions. We recorded other expense, net of $83,000 for the year ended December 31, 2018, as compared to other expense, net of $4,000 for the year ended December 31, 2017.

Income tax expense

We are subject to income taxes in both the United States and foreign jurisdictions. The effective income tax rate was 8.5% and 30.5% for the years ended December 30, 2018 and 2017, respectively, and we recorded income tax expense of $5.5 million and $45.7 million, respectively. The recorded amounts include deductions for employee share awards in excess of compensation costs (“windfalls”) under ASU No. 2016-09 for the years ended December 31, 2018 and 2017, and a one-time charge of $11.5 million in the fourth quarter of 2017 due to the enactment of the Tax Cuts and Jobs Act (TCJA). The effective income tax rate for the year ended December 31, 2018 reflected benefits from a higher research and development credit, the reversal of the repatriation tax recorded in 2017 and a foreign-derived intangible income deduction (FDII).

Without the $1.1 million benefit of ASU No. 2016-09, for the year ended December 31, 2018, the effective income tax rate and income tax expense would have been 10.2% and $6.6 million, respectively. Without the benefit of ASU No. 2016-09 and the enactment of the TCJA, for the year ended December 31, 2017, the effective income tax rate and income expense would have been 24.8%, and $37.2 million.

For the years ended December 31, 2018 and 2017, the Company incurred Korean withholding tax of $14.9 million and $17.6 million, respectively, which is currently being appealed based on the interpretation of the Korean – U. S. tax treaty and recent Korean Supreme Court decisions.

Comparison of the Years Ended December 31, 2017 and 2016

	Year Ended December 31,		
	2017	2016	Increase (Decrease)
REVENUE	$335,629	$198,886	$136,743
COST OF SALES	54,698	26,288	28,410
Gross margin	280,931	172,598	108,333
OPERATING EXPENSES:			
Research and development	49,144	42,744	6,400
Selling, general and administrative	46,808	32,876	13,932
Amortization of acquired technology and other intangible assets	21,983	16,493	5,490
Patent costs	7,010	6,249	761
Royalty and license expense	9,739	5,823	3,916
Total operating expenses	134,684	104,185	30,499
OPERATING INCOME	146,247	68,413	77,834
Interest income, net	3,294	2,113	1,181
Other expense, net	(4)	(1,928)	1,924
Interest and other expense, net	3,290	185	3,105
INCOME BEFORE INCOME TAXES	149,537	68,598	80,939
INCOME TAX EXPENSE	(45,652)	(20,528)	(25,124)
NET INCOME	$103,885	$48,070	$55,815

Revenue

Total revenue for the year ended December 31, 2017 increased by $136.7 million as compared to the year ended December 31, 2016. The increase in revenue was the result of an increase in material sales due to an increase in sales volume resulting from higher demand for both red and green phosphorescent emitters.

Revenue derived from OLED sales comprised 97% of total revenue for the year ended December 31, 2017 as compared to 98% for the year ended December 31, 2016. The remaining portion of our revenue was derived from contract research services. Contract research services include revenue earned by our subsidiary, Adesis, which performs organic and organometallic synthetics research, development and commercialization on a contractual basis for our customers.

Cost of Sales

Cost of sales for the year ended December 31, 2017 increased by $28.4 million as compared to the year ended December 31, 2016 and was primarily due to an increase in the level of material sales. As a result, gross margin for the year ended December 31, 2017 increased by $108.3 million as compared to the year ended December 31, 2016 with gross margin as a percentage of sales decreasing to 84% from 87%, respectively.

Research and development

Research and development expenses increased to $49.1 million for the year ended December 31, 2017, as compared to $42.7 million for the year ended December 31, 2016. The increase in research and development expenses was primarily due to higher third-party contract research activities as well as higher employee-related costs.

Selling, general and administrative

Selling, general and administrative expenses increased to $46.8 million for the year ended December 31, 2017, as compared to $32.9 million for the year ended December 31, 2016. The increase in selling, general and administrative expenses was primarily due to incremental costs associated with the addition of Adesis activity, as well as higher employee-related costs and other operating expenses.

Amortization of acquired technology and other intangible assets

Amortization of acquired technology and other intangible assets increased to $22.0 million for the year ended December 31, 2017, as compared to $16.5 million for the year ended December 31, 2016. The increase was due to higher amortization expense of $5.5 million associated with the acquisitions of the BASF patent portfolio and intangible assets associated with the Adesis acquisition. See Note 8 in Notes to Consolidated Financial Statements for further discussion.

Patent costs

Patent costs increased to $7.0 million for the year ended December 31, 2017, as compared to $6.2 million for the year ended December 31, 2016.

Royalty and license expense

Royalty and license expense increased to $9.7 million for the year ended December 31, 2017, as compared to $5.8 million for the year ended December 31, 2016. The increase was due to increased royalties incurred under our amended license agreement with Princeton, USC, and Michigan, resulting from an increase in royalty and license fees and qualifying material sales. See Note 10 in Notes to Consolidated Financial Statements for further discussion.

Interest income, net and other expense, net

Interest income, net, was $3.3 million for the year ended December 31, 2017, as compared to $2.1 million for the year ended December 31, 2016. The increase in interest income, net was primarily due to the increase in available-for-sale investments held during the year ended December 31, 2017 over amounts held in the comparable period in 2016. Other expense, net primarily consisted of net exchange gains and losses on foreign currency transactions. We recorded other expense, net of $4,000 for the year ended December 31, 2017, as compared to other expense, net of $1.9 million for the year ended December 31, 2016. Other expense, net for the year ended December 31, 2016 primarily consisted of exchange losses on foreign currency associated with the BASF OLED patent acquisition.

Income tax expense

We are subject to income taxes in both the United States and foreign jurisdictions. The effective income tax rate was 30.5% and 29.9%, for the years ended December 31, 2017 and 2016, respectively, and the Company recorded income tax expense of $45.7 million and $20.5 million, respectively. The effective income tax rate for the year ended December 31, 2017 reflected a benefit from the utilization of a valuation allowance at UDC Ireland.

The enactment of the Tax Cuts and Jobs Act in December 2017 resulted in a one-time charge of $11.5 million in the fourth quarter. The charge includes two elements, a tax on accumulated overseas profits and the revaluation of deferred tax assets and liabilities. Without the TCJA, for the year ended December 31, 2017, the effective income tax rate and income tax expense would have been 22.8% and $34.2 million.

On January 1, 2017, we adopted ASU No. 2016-09, Improvements to Employee Share-Based Accounting, which includes provisions intended to simplify various aspects related to how share-based payments are accounted for and presented in the financial statements. Under the previous guidance, tax effects of deductions for employee share awards in excess of compensation cost ("windfalls") were recorded in equity in the period in which the deductions actually reduced income taxes payable and any unrecognized tax benefits were tracked separately off the balance sheet. Under the new guidance, excess tax benefits and deficiencies are recorded in the income statement in the period in which stock awards vest or are settled, and any excess tax benefits not previously recognized because the related tax deduction had not reduced current taxes payable are recorded through a cumulative-effect adjustment to retained earnings at the beginning of the period of adoption.

Without the adoption of ASU No. 2016-09 and the enactment of TCJA, for the year ended December 31, 2017, the effective income tax rate and income tax expense would have been 24.8% and $37.2 million.

For the years ended December 31, 2017 and 2016, the Company incurred Korean withholding tax of $17.6 million and $14.4 million, respectively, which is currently being appealed based on the interpretation of the Korean – U. S. tax treaty and recent Korean Supreme Court decisions.

Liquidity and Capital Resources

Our principal sources of liquidity are our cash and cash equivalents and our investments. As of December 31, 2018, we had cash and cash equivalents of $211.0 million and short-term investments of $304.3 million, for a total of $515.3 million. This compares to cash and cash equivalents of $132.8 million, short-term investments of $287.5 million and long-term investments of $14.8 million, for a total of $435.1 million, as of December 31, 2017.

Cash provided by operating activities was $121.8 million for the year ended December 31, 2018, compared to cash provided by operating activities of $133.4 million for the year ended December 31, 2017. The decrease in cash provided by operating activities of $11.6 million was primarily due to a decrease in non-cash adjustments to net income of $89.5 million and a decrease in net income of

$45.0 million. This decrease was partially offset by an increase in cash due to changes in net operating assets and liabilities of $122.9 million, which included an increase in deferred revenue and other liabilities and a decrease in deferred income taxes and accounts receivable, partially offset by an increase in other assets and inventory. The increase in the balances of other assets and other liabilities is due to the anticipated favorable settlement with the Korean tax authorities.

Cash used in investing activities was $21.0 million for the year ended December 31, 2018, as compared to cash used in investing activities of $125.6 million for the year ended December 31, 2017. The decrease in cash used by investing activities of $104.6 million was primarily due to the timing of maturities and purchases of investments resulting in net sales of $4.4 million for the year ended December 31, 2018, as compared to net purchases of $95.8 million for the year ended December 31, 2017, and a decrease in purchases of property, plant and equipment of $4.4 million for the year ended December 31, 2018 compared to the year ended December 31, 2017. The decrease in property, plant, and equipment purchases was primarily due to the expansion of our OLED manufacturing facility managed by our subcontractor PPG in Ohio during 2017, partially offset by the purchase of research and development lab equipment as well as expansion of our Adesis manufacturing facility in Delaware during 2018.

Cash used in financing activities was $22.6 million for the year ended December 31, 2018, as compared to $14.3 million for the year ended December 31, 2017. The increase in cash used in financing activities of $8.3 million was due to an increase in the cash payment of dividends in the current year of $5.7 million, an increase in the payment of withholding taxes related to stock-based compensation to employees of $2.2 million and repurchase of common stock of $477,000, partially offset by an increase in proceeds from the issuance of common stock of $64,000.

Working capital was $501.7 million as of December 31, 2018, compared to $455.4 million as of December 31, 2017. The increase in working capital was primarily due to an increase in cash and cash equivalents, inventory and short-term investments, partially offset by an increase in deferred revenue and other current liabilities and a decrease in accounts receivable.

We anticipate, based on our internal forecasts and assumptions relating to our operations (including, among others, assumptions regarding our working capital requirements, the progress of our research and development efforts, the availability of sources of funding for our research and development work, and the timing and costs associated with the preparation, filing, prosecution, maintenance, defense and enforcement of our patents and patent applications), that we have sufficient cash, cash equivalents and short-term investments to meet our obligations for at least the next twelve months.

We believe that potential additional financing sources for us include long-term and short-term borrowings, public and private sales of our equity and debt securities and the receipt of cash upon the exercise of outstanding stock options. It should be noted, however, that additional funding may be required in the future for research, development and commercialization of our OLED technologies and materials, to obtain, maintain and enforce patents respecting these technologies and materials, and for working capital and other purposes, the timing and amount of which are difficult to ascertain. There can be no assurance that additional funds will be available to us when needed, on commercially reasonable terms or at all, particularly in the current economic environment.

Contractual Obligations

As of December 31, 2018, we had the following contractual commitments:

	Payments due by period (in thousands)				
Contractual Obligations	Total	Less than	1-3 years	3-5 years	More than 5

		1 year			years
Estimated retirement plan benefit payments	$65,363	$—	$7,191	$8,549	$ 49,623
Lease obligations	10,852	2,320	2,747	1,743	4,042
Purchasing obligations	15,858	15,858	—	—	—
Research related obligations	6,532	4,921	1,611	—	—
Minimum royalty obligation (1)	500	100	200	200	$100/year
Total (2)	$99,105	$23,199	$11,749	$10,492	$ 53,665

(1) Under the 1997 Amended License Agreement, we are obligated to pay Princeton minimum royalties of $100,000 per year until the agreement is no longer in effect. The agreement has no scheduled expiration date.

(2) See Note 16 to the Consolidated Financial Statements for discussion of obligations upon termination of employment of executive officers as a result of a change in our control.

Off-Balance Sheet Arrangements

As of December 31, 2018, we had no off-balance sheet arrangements in the nature of guarantee contracts, retained or contingent interests in assets transferred to unconsolidated entities (or similar arrangements serving as credit, liquidity or market risk support to unconsolidated entities for any such assets), or obligations (including contingent obligations) arising out of variable interests in unconsolidated entities providing financing, liquidity, market risk or credit risk support to us, or that engage in leasing, hedging or research and development services with us.

Recently Issued Accounting Pronouncements

Recently issued accounting pronouncements are addressed in Note 2 in the Notes to Consolidated Financial Statements.

ITEM 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

We do not utilize financial instruments for trading purposes and hold no derivative financial instruments, other financial instruments or derivative commodity instruments that could expose us to significant market risk other than our investments disclosed in “Fair Value Measurements” in Note 5 to the Consolidated Financial Statements included herein. We generally invest in investment grade financial instruments to reduce our exposure related to investments. Our primary market risk exposure with regard to such financial instruments is to changes in interest rates, which would impact interest income earned on investments. However, based upon the conservative nature of our investment portfolio and current experience, we do not believe a decrease in investment yields would have a material negative effect on our interest income.

Substantially all our revenue is derived from outside of North America. All revenue is primarily denominated in U.S. dollars and therefore we bear no significant foreign exchange risk.

ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

Our Consolidated Financial Statements and the related notes to those statements are attached to this report beginning on page F-1.

ITEM 9. CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE

None.

ITEM 9A. CONTROLS AND PROCEDURES

Evaluation of Disclosure Controls and Procedures

Our management, with the participation of our Chief Executive Officer and Chief Financial Officer, evaluated the effectiveness of our disclosure controls and procedures as of December 31, 2018. Based on that evaluation, the Chief Executive Officer and Chief Financial Officer concluded that our disclosure controls and procedures, as of the end of the period covered by this report, are effective to provide reasonable assurance that the information required to be disclosed by us in reports filed or submitted under the Securities Exchange Act of 1934, as amended, is (i) recorded, processed, summarized and reported within the time periods specified in the SEC’s rules and forms, and (ii) accumulated and communicated to our management, including the Chief Executive Officer and Chief Financial Officer, as appropriate to allow timely decisions regarding disclosure. However, a controls system, no matter how well designed and operated, cannot provide absolute assurance that the objectives of the controls system are met, and no evaluation of controls can provide absolute assurance that all control issues and instances of fraud, if any, within a company have been detected.

Management's Report on Internal Control over Financial Reporting and Report of Independent Registered Public Accounting Firm on Internal Control over Financial Reporting

The report of management on our internal control over financial reporting and the associated attestation report of our independent registered public accounting firm are set forth in Item 8 of this report.

Changes in Internal Control over Financial Reporting

There were no changes in our internal control over financial reporting during the quarter ended December 31, 2018 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

ITEM 9B. OTHER INFORMATION
None.

PART III

ITEM 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

Information with respect to this item is set forth in our definitive Proxy Statement for the 2019 Annual Meeting of Shareholders, which is to be filed with the Securities and Exchange Commission no later than April 30, 2019 (our "Proxy Statement"), and which is incorporated herein by reference. Information regarding our executive officers is included at the end of Part I of this report.

ITEM 11. EXECUTIVE COMPENSATION

Information with respect to this item will be set forth in our Proxy Statement, and is incorporated herein by reference.

ITEM 12. SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS

Information with respect to this item will be set forth in our Proxy Statement, and is incorporated herein by reference.

ITEM 13. CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS, AND DIRECTOR INDEPENDENCE

Information with respect to this item will be set forth in our Proxy Statement, and is incorporated herein by reference.

ITEM 14. PRINCIPAL ACCOUNTANT FEES AND SERVICES

Information with respect to this item will be set forth in our Proxy Statement, and is incorporated herein by reference.

PART IV

ITEM 15. EXHIBITS AND FINANCIAL STATEMENT SCHEDULES

(a) The following documents are filed as part of this report:

(1) Financial Statements:

(2) Financial Statement Schedules:

None.

(3) Exhibits:

The following is a list of the exhibits filed as part of this report. Where so indicated by footnote, exhibits that were previously filed are incorporated by reference. For exhibits incorporated by reference, the location of the exhibit in the previous filing is indicated parenthetically, together with a reference to the filing indicated by footnote.

Exhibit Number	Description
3.1	Amended and Restated Articles of Incorporation of the registrant (1)
3.2	Amended and Restated Bylaws of the registrant (2)
10.1#	Amended and Restated Change in Control Agreement between the registrant and Sherwin I. Seligsohn, dated as of November 4, 2008 (3)
10.2#	Amended and Restated Change in Control Agreement between the registrant and Steven V. Abramson, dated as of November 4, 2008 (3)
10.3#	Amended and Restated Change in Control Agreement between the registrant and Sidney D. Rosenblatt, dated as of November 4, 2008 (3)
10.4#	Amended and Restated Change in Control Agreement between the registrant and Julia J. Brown, dated as of November 4, 2008 (3)
10.5#	Amended and Restated Change in Control Agreement between the registrant and Janice M. DuFour, dated as of November 4, 2008 (3)
10.6#	Non-Competition and Non-Solicitation Agreement between the registrant and Sherwin I. Seligsohn, dated as of February 23, 2007 (4)
10.7#	Non-Competition and Non-Solicitation Agreement between the registrant and Steven V. Abramson, dated as of January 26, 2007 (4)
10.8#	Non-Competition and Non-Solicitation Agreement between the registrant and Sidney D. Rosenblatt, dated as of February 7, 2007 (4)

10.9#	Non-Competition and Non-Solicitation Agreement between the registrant and Julia J. Brown, dated as of February 5, 2007 (4)
10.10#	Non-Competition and Non-Solicitation Agreement between the registrant and Janice M. DuFour, dated as of February 23, 2007 (3)
10.11#	Equity Retention Agreement between the registrant and Steven V. Abramson, dated as of March 18, 2010 (5)
10.12#	Equity Retention Agreement between the registrant and Sidney D. Rosenblatt, dated as of March 18, 2010 (5)
10.13#	Equity Retention Agreement between the registrant and Julia J. Brown, dated as of January 6, 2011 (6)
10.14#	Equity Retention Agreement between the registrant and Janice M. DuFour, dated as of January 6, 2011 (6)

Exhibit Number	Description
10.15#	Equity Retention Agreement between the registrant and Julia J. Brown, dated as of March 8, 2012 (7)
10.16#	Equity Retention Agreement between the registrant and Janice M. DuFour, dated as of March 8, 2012 (7)
10.17#	Amended and Restated Change in Control Agreement between the Registrant and Mauro Premutico, dated April 16, 2012 (8)
10.18#	Equity Retention Agreement between the Registrant and Mauro Premutico, dated April 16, 2012 (8)
10.19#	Supplemental Executive Retirement Plan, dated as of April 1, 2010 (5)
10.20#	Amended and Restated Equity Compensation Plan, effective as of March 7, 2013 (9)
10.21	Sponsored Research Agreement between the registrant and the University of Southern California, dated as of May 1, 2006 (10)
10.22	Amendment No. 1 to the Sponsored Research Agreement between the registrant and the University of Southern California, dated as of May 1, 2006 (3)
10.23	Amendment No. 2 to the Sponsored Research Agreement between the registrant and the University of Southern California, dated as of May 7, 2009 (11)
10.24	1997 Amended License Agreement among the registrant, The Trustees of Princeton University and the University of Southern California, dated as of October 9, 1997 (12)
10.25	Amendment #1 to the Amended License Agreement among the registrant, the Trustees of Princeton University and the University of Southern California, dated as of August 7, 2003 (13)
10.26	Amendment #2 to the Amended License Agreement among the registrant, the Trustees of Princeton University, the University of Southern California and the Regents of the University of Michigan, dated as of January 1, 2006 (10)
10.27	Termination, Amendment and License Agreement by and among the registrant, PD-LD, Inc., Dr. Vladimir S. Ban, and The Trustees of Princeton University, dated as of July 19, 2000 (14)
10.28	Letter of Clarification of UDC/GPEC Research and License Arrangements between the registrant and Global Photonic Energy Corporation, dated as of June 4, 2004 (4)
10.29+	Amended and Restated OLED Materials Supply and Service Agreement between the registrant and PPG Industries, Inc., dated as of October 1, 2011 (15)
10.30+	OLED Patent License Agreement between the registrant and Samsung Display Co., Ltd., dated as of February 13, 2018 (16)
10.31+	Supplemental OLED Material Purchase Agreement between the registrant and Samsung Display Co., Ltd., dated as of February 13, 2018 (16)
10.32+	Settlement and License Agreement between the registrant and Seiko Epson Corporation, dated as of July 31, 2006 (17)
10.33+	Amendment No. 1 to the Settlement and License Agreement between the registrant and Seiko Epson Corporation, dated as of March 30, 2009 (18)
10.33+	OLED Technology License Agreement between the registrant and Konica Minolta Holdings, Inc., dated as of August 11, 2008 (19)
10.34+	Limited-Term OLED Technology License Agreement between the registrant and Panasonic Idemitsu OLED Lighting Co., Ltd., dated as of August 1, 2011 (15)
10.35+	OLED Technology License Agreement between the registrant and Pioneer Corporation, dated as of May 1, 2011 (20)
10.36+	Patent Sale Agreement, dated as of July 23, 2012 by and between FUJIFILM Corporation and the Company (21)
10.37	Amendment No. 3 to the Sponsored Research Agreement between the registrant and the University of Southern California, dated as of June 1, 2013 (22)
10.38#	Universal Display Corporation Annual Incentive Plan (23)
10.39#	Form Agreement - Restricted Stock Unit Grant Letter (24)
10.40#	Form Agreement - Performance Unit Grant Letter (24)
10.41#	Universal Display Corporation Equity Compensation Plan (25)
10.42#	

	Amendment 2015-1, dated March 3, 2015, to Universal Display Corporation Supplemental Executive Retirement Plan (26)
10.43#	Equity Retention Agreement between the Registrant and Steven V. Abramson, dated April 7, 2015 (27)

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Exhibit Number	Description
10.44#	Equity Retention Agreement between the Registrant and Sidney D. Rosenblatt, dated April 7, 2015 (27)
10.45#	Equity Retention Agreement between the Registrant and Julia J. Brown, dated September 10, 2015 (28)
10.46#	Equity Retention Agreement between the Registrant and Mauro Premutico, dated September 10, 2015 (28)
10.47+	IP Transfer Agreement, dated June 28, 2016 by and between UDC Ireland Limited and BASF SE (29)
21*	Subsidiaries of the registrant
23.1*	Consent of KPMG LLP
31.1*	Certifications of Steven V. Abramson, Chief Executive Officer, as required by Rule 13a-14(a) or Rule 15d-14(a)
31.2*	Certifications of Sidney D. Rosenblatt, Chief Financial Officer, as required by Rule 13a-14(a) or Rule 15d-14(a)
32.1**	Certifications of Steven V. Abramson, Chief Executive Officer, as required by Rule 13a-14(b) or Rule 15d-14(b), and by 18 U.S.C. Section 1350. (This exhibit shall not be deemed "filed" for purposes of Section 18 of the Securities Exchange Act of 1934, as amended, or otherwise subject to the liability of that section. Further, this exhibit shall not be deemed to be incorporated by reference into any filing under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended.)
32.2**	Certifications of Sidney D. Rosenblatt, Chief Financial Officer, as required by Rule 13a-14(b) or Rule 15d-14(b), and by 18 U.S.C. Section 1350. (This exhibit shall not be deemed "filed" for purposes of Section 18 of the Securities Exchange Act of 1934, as amended, or otherwise subject to the liability of that section. Further, this exhibit shall not be deemed to be incorporated by reference into any filing under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended.)
101.INS*	XBRL Instance Document
101.SCH*	XBRL Taxonomy Extension Schema Document
101.CAL*	XBRL Taxonomy Extension Calculation Linkbase Document
101.DEF*	XBRL Taxonomy Extension Definition Linkbase Document
101.LAB*	XBRL Taxonomy Extension Label Linkbase Document
101.PRE*	XBRL Taxonomy Extension Presentation Linkbase Document

Explanation of footnotes to listing of exhibits:

*Filed herewith.

**Furnished herewith.

#Management contract or compensatory plan or arrangement.

+Confidential treatment has been accorded to certain portions of this exhibit pursuant to Rule 406 under the Securities Act of 1933, as amended, or Rule 24b-2 under the Securities Exchange Act of 1934, as amended.

(1) Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended June 30, 2018, filed with the SEC on August 9, 2018.

(2) Filed as an Exhibit to the Annual Report on Form 10-K for the year ended December 31, 2003, filed with the SEC on March 1, 2004.

(3) Filed as an Exhibit to the Annual Report on Form 10-K for the year ended December 31, 2008, filed with the SEC on March 12, 2009.

(4) Filed as an Exhibit to the Annual Report on Form 10-K for the year ended December 31, 2006, filed with the SEC on March 15, 2007.

(5) Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended March 31, 2010, filed with the SEC on May 10, 2010.

(6) Filed as an Exhibit to a Current Report on Form 8-K, filed with the SEC on March 21, 2011.

(7)

Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended March 31, 2012, filed with the SEC on May 9, 2012.

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(8) Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended June 30, 2012, filed with the SEC on August 8, 2012.
(9) Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended March 31, 2013, filed with the SEC on May 9, 2013.
(10) Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended June 30, 2006, filed with the SEC on August 9, 2006.
(11) Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended June 30, 2009, filed with the SEC on August 10, 2009.
(12) Filed as an Exhibit to the Annual Report on Form 10K-SB for the year ended December 31, 1997, filed with the SEC on March 31, 1998.
(13) Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended September 30, 2003, filed with the SEC on November 10, 2003.
(14) Filed as an Exhibit to the amended Quarterly Report on Form 10-Q for the quarter ended September 30, 2000, filed with the SEC on November 20, 2001.
(15) Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended September 30, 2011, filed with the SEC on November 8, 2011.
(16) Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended March 31, 2018, filed with the SEC on May 3, 2018.
(17) Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended September 30, 2006, filed with the SEC on November 6, 2006.
(18) Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended March 31, 2009, filed with the SEC on May 7, 2009.
(19) Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended September 30, 2008, filed with the SEC on November 6, 2008.
(20) Filed as an Exhibit to Amendment No. 1 to the Quarterly Report on Form 10-Q for the quarter ended September 30, 2011, filed with the SEC on January 27, 2012.
(21) Filed as an Exhibit to a Current Report on Form 8-K, filed with the SEC on July 27, 2012.
(22) Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended September 30, 2013, filed with the SEC on November 7, 2013.
(23) Filed as an Exhibit to a Current Report on Form 8-K, filed with the SEC on June 24, 2013.
(24) Filed as an Exhibit to the Annual Report on Form 10-K for the year ended December 31, 2013, filed with the SEC on February 28, 2014.
(25) Filed as Exhibit A to the Company's Definitive Proxy Statement for the 2014 Annual Meeting filed with the SEC on April 25, 2014.
(26) Filed as an exhibit to the Current Report on Form 8-K filed with the SEC on March 9, 2015.
(27) Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended June 30, 2015, filed with the SEC on August 6, 2015.
(28) Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended September 30, 2015, filed with the SEC on November 5, 2015.
(29) Filed as an Exhibit to the Quarterly Report on Form 10-Q for the quarter ended June 30, 2016, filed with the SEC on August 4, 2016.

Note: Any of the exhibits listed in the foregoing index not included with this report may be obtained, without charge, by writing to Mr. Sidney D. Rosenblatt, Corporate Secretary, Universal Display Corporation, 375 Phillips Boulevard, Ewing, New Jersey 08618.

(b) The exhibits required to be filed by us with this report are listed above.

(c) The consolidated financial statement schedules required to be filed by us with this report are listed above.

ITEM 16. FORM 10-K SUMMARY

None.

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SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

UNIVERSAL DISPLAY CORPORATION

By: /s/ Sidney D. Rosenblatt
Sidney D. Rosenblatt
Executive Vice President, Chief Financial Officer,
Treasurer and Secretary

Date: February 21, 2019

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities and on the dates indicated.

Name	Title	Date
/s/ Sherwin I. Seligsohn Sherwin I. Seligsohn	Founder and Chairman of the Board of Directors	February 21, 2019
/s/ Steven V. Abramson Steven V. Abramson	President, Chief Executive Officer and Director (principal executive officer)	February 21, 2019
/s/ Sidney D. Rosenblatt Sidney D. Rosenblatt	Executive Vice President, Chief Financial Officer, Treasurer, Secretary and Director (principal financial and accounting officer)	February 21, 2019
/s/ Richard C. Elias Richard C. Elias	Director	February 21, 2019
/s/ Elizabeth H. Gemmill C. Elizabeth H. Gemmill	Director	February 21, 2019
/s/ Rosemarie B. Greco Rosemarie B. Greco	Director	February 21, 2019
/s/ C. Keith Hartley C. Keith Hartley	Director	February 21, 2019

/s/ Lawrence Lacerte Lawrence Lacerte	Director	February 21, 2019

UNIVERSAL DISPLAY CORPORATION AND SUBSIDIARIES

INDEX TO CONSOLIDATED FINANCIAL STATEMENTS

MANAGEMENT'S REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING

Our management is responsible for establishing and maintaining adequate internal control over financial reporting for the Company. Internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of consolidated financial statements for external purposes in accordance with generally accepted accounting principles. Our system of internal control over financial reporting includes those policies and procedures that (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the Company; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the Company are being made only in accordance with authorizations of management and directors of the Company; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of the Company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Management performed an assessment of the effectiveness of our internal control over financial reporting as of December 31, 2018 based upon criteria in Internal Control — Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). Based on this assessment, management determined that the Company's internal control over financial reporting was effective as of December 31, 2018, based on the criteria in Internal Control-Integrated Framework (2013) issued by COSO.

The effectiveness of our internal control over financial reporting as of December 31, 2018, has been attested to by KPMG LLP, an independent registered public accounting firm, as stated in its report which appears on the following page.

Steven V. Abramson	Sidney D. Rosenblatt
President and Chief Executive Officer	Executive Vice President and Chief Financial Officer

February 21, 2019

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Board of Directors and Shareholders

Universal Display Corporation:

Opinion on Internal Control Over Financial Reporting

We have audited Universal Display Corporation and subsidiaries' (the Company) internal control over financial reporting as of December 31, 2018, based on criteria established in Internal Control - Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission. In our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2018, based on criteria established in Internal Control - Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the consolidated balance sheets of the Company as of December 31, 2018 and 2017, the related consolidated statements of income, comprehensive income, shareholders' equity, and cash flows for each of the years in the three-year period ended December 31, 2018, and the related notes (collectively, the consolidated financial statements), and our report dated February 21, 2019 expressed an unqualified opinion on those consolidated financial statements.

Basis for Opinion

The Company's management is responsible for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management's Report on Internal Control over Financial Reporting. Our responsibility is to express an opinion on the Company's internal control over financial reporting based on our audit. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audit also included performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

Definition and Limitations of Internal Control over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

/s/ KPMG LLP

Philadelphia, Pennsylvania

February 21, 2019

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Board of Directors and Shareholders

Universal Display Corporation:

Opinion on the Consolidated Financial Statements

We have audited the accompanying consolidated balance sheets of Universal Display Corporation and subsidiaries (the Company) as of December 31, 2018 and 2017, and the related consolidated statements of income, comprehensive income, shareholders' equity, and cash flows for each of the years in the three-year period ended December 31, 2018, and the related notes (collectively, the consolidated financial statements). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2018 and 2017, and the results of its operations and its cash flows for each of the years in the three-year period ended December 31, 2018, in conformity with U.S. generally accepted accounting principles.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the Company's internal control over financial reporting as of December 31, 2018, based on criteria established in Internal Control — Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission, and our report dated February 21, 2019 expressed an unqualified opinion on the effectiveness of the Company's internal control over financial reporting.

Changes in Accounting Principle

As discussed in Note 2 to the consolidated financial statements, the Company changed its method for accounting for revenue from contracts with customers due to the adoption of Accounting Standards Codification (ASC) Topic 606, Revenue from Contracts with Customers. The Company adopted the standard effective January 1, 2018 using the modified retrospective adoption method.

Also, the Company elected to change its method of accounting for share-based payment transactions in 2017 due to the adoption of amendments to the FASB ASC resulting from Accounting Standards Update No. 2016-09, Compensation - Stock Compensation (Topic 718): Improvements to Employee Share-Based Payment Accounting, effective January 1, 2017.

Basis for Opinion

These consolidated financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on these consolidated financial statements based on our audits. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud. Our audits included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. We believe that our audits provide a reasonable basis for our opinion.

/s/ KPMG LLP

We have served as the Company’s auditor since 2002.

Philadelphia, Pennsylvania

February 21, 2019

UNIVERSAL DISPLAY CORPORATION AND SUBSIDIARIES

CONSOLIDATED BALANCE SHEETS

(in thousands, except share and per share data)

	December 31, 2018	December 31, 2017
ASSETS		
CURRENT ASSETS:		
Cash and cash equivalents	$ 211,022	$ 132,840
Short-term investments	304,323	287,446
Accounts receivable	43,129	52,355
Inventory	70,000	36,265
Other current assets	6,366	10,276
Total current assets	634,840	519,182
PROPERTY AND EQUIPMENT, net of accumulated depreciation of $44,943 and $36,368	69,739	56,450
ACQUIRED TECHNOLOGY, net of accumulated amortization of $111,890 and $91,312	110,951	131,529
OTHER INTANGIBLE ASSETS, net of accumulated amortization of $3,384 and $2,000	13,456	14,840
GOODWILL	15,535	15,535
INVESTMENTS	—	14,794
DEFERRED INCOME TAXES	24,377	27,022
OTHER ASSETS	64,526	604
TOTAL ASSETS	$ 933,424	$ 779,956
LIABILITIES AND SHAREHOLDERS' EQUITY		
CURRENT LIABILITIES:		
Accounts payable	$ 10,532	$ 13,774
Accrued expenses	36,057	35,019
Deferred revenue	80,782	14,981
Other current liabilities	5,811	50
Total current liabilities	133,182	63,824
DEFERRED REVENUE	41,785	23,902
RETIREMENT PLAN BENEFIT LIABILITY	44,055	33,176
OTHER LIABILITIES	23,896	—
Total liabilities	242,918	120,902
COMMITMENTS AND CONTINGENCIES (Note 16)		
SHAREHOLDERS' EQUITY:		
Preferred Stock, par value $0.01 per share, 5,000,000 shares authorized, 200,000 shares of Series A Nonconvertible Preferred Stock issued and outstanding (liquidation value of $7.50 per share or $1,500)	2	2
Common Stock, par value $0.01 per share, 200,000,000 shares authorized, 48,681,524 and 48,476,034 shares issued, and 47,319,887 and 47,118,171 shares outstanding at	487	485

December 31, 2018 and December 31, 2017, respectively		
Additional paid-in capital	617,334	611,063
Retained earnings	129,552	99,126
Accumulated other comprehensive loss	(16,234)	(11,464)
Treasury stock, at cost (1,361,637 and 1,357,863 shares at December 31, 2018 and December 31, 2017)	(40,635)	(40,158)
Total shareholders' equity	690,506	659,054
TOTAL LIABILITIES AND SHAREHOLDERS' EQUITY	$ 933,424	$ 779,956

The accompanying notes are an integral part of these consolidated financial statements.

UNIVERSAL DISPLAY CORPORATION AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF INCOME

(in thousands, except share and per share data)

	Year Ended December 31,		
	2018	2017	2016
REVENUE	$247,414	$335,629	$198,886
COST OF SALES	53,541	54,698	26,288
Gross margin	193,873	280,931	172,598
OPERATING EXPENSES:			
Research and development	53,717	49,144	42,744
Selling, general and administrative	46,999	46,808	32,876
Amortization of acquired technology and other intangible assets	21,962	21,983	16,493
Patent costs	7,464	7,010	6,249
Royalty and license expense	6,996	9,739	5,823
Total operating expenses	137,138	134,684	104,185
OPERATING INCOME	56,735	146,247	68,413
Interest income, net	7,659	3,294	2,113
Other expense, net	(83)	(4)	(1,928)
Interest and other expense, net	7,576	3,290	185
INCOME BEFORE INCOME TAXES	64,311	149,537	68,598
INCOME TAX EXPENSE	(5,471)	(45,652)	(20,528)
NET INCOME	$58,840	$103,885	$48,070
NET INCOME PER COMMON SHARE:			
BASIC	$1.24	$2.19	$1.02
DILUTED	$1.24	$2.18	$1.02
WEIGHTED AVERAGE SHARES USED IN COMPUTING NET INCOME PER COMMON SHARE:			
BASIC	46,849,588	46,725,289	46,408,460
DILUTED	46,896,766	46,805,194	46,535,980
CASH DIVIDEND DECLARED PER COMMON SHARE	$0.24	$0.12	$—

The accompanying notes are an integral part of these consolidated financial statements.

UNIVERSAL DISPLAY CORPORATION AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME

(in thousands)

	Year Ended December 31,		
	2018	2017	2016
NET INCOME	$58,840	$103,885	$48,070
OTHER COMPREHENSIVE INCOME (LOSS), NET OF TAX:			
Unrealized gain (loss) on available-for-sale securities, net of tax of $74, $7 and $72, respectively	268	(12)	(135)
Employee benefit plan:			
Actuarial loss on retirement plan, net of tax of $1,841, $1,047 and $945, respectively	(6,690)	(1,904)	(1,731)
Plan amendment cost, net of tax of none, $154 and none, respectively	—	(280)	—
Amortization of plan amendment cost, prior service cost and actuarial loss for retirement plan included in net periodic pension costs, net of tax of $457, $754 and $591, respectively	1,661	1,370	1,084
Net change for employee benefit plan	(5,029)	(814)	(647)
Change in cumulative foreign currency translation adjustment	(9)	28	(65)
TOTAL OTHER COMPREHENSIVE LOSS	(4,770)	(798)	(847)
COMPREHENSIVE INCOME	$54,070	$103,087	$47,223

The accompanying notes are an integral part of these consolidated financial statements.

UNIVERSAL DISPLAY CORPORATION AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF SHAREHOLDERS' EQUITY

(in thousands, except for share data)

	Series A Nonconvertible Preferred Stock		Common Stock		Additional Paid-in	Retained	Accumulated Other Comprehensive	Treasury Stock		Total Shareholders'
	Shares	Amount	Shares	Amount	Capital	Earnings	Loss	Shares	Amount	Equity
BALANCE, JANUARY 1, 2016	200,000	$2	48,132,223	$482	$589,885	$(73,627)	$(9,819)	1,357,863	$(40,158)	466,765
Net income	—	—	—	—	—	48,070	—	—	—	48,070
Other comprehensive loss	—	—	—	—	—	—	(847)	—	—	(847)
Exercise of common stock options	—	—	12,750	—	185	—	—	—	—	185
Issuance of common stock to employees	—	—	165,826	2	12,354	—	—	—	—	12,356
Shares withheld for employee taxes	—	—	(92,241)	(1)	(4,870)	—	—	—	—	(4,871)
Excess tax benefits from share-based payment arrangements	—	—	—	—	4,232	—	—	—	—	4,232
Issuance of common stock to Board of Directors and Scientific Advisory Board	—	—	43,046	—	2,012	—	—	—	—	2,012
Issuance of common stock to employees under an ESPP	—	—	9,386	—	566	—	—	—	—	566
BALANCE, DECEMBER 31, 2016	200,000	2	48,270,990	483	604,364	(25,557)	(10,666)	1,357,863	(40,158)	528,468

Cumulative effect of recording excess tax benefits from share-based payment arrangements	—	—	—	—	—	26,450	—	—	—	26,450
Net income	—	—	—	—	—	103,885	—	—	—	103,885
Other comprehensive loss	—	—	—	—	—	—	(798)	—	—	(798)
Cash dividend	—	—	—	—	—	(5,652)	—	—	—	(5,652)
Exercise of common stock options	—	—	2,250	—	38	—	—	—	—	38
Issuance of common stock to employees	—	—	265,233	3	12,239	—	—	—	—	12,242
Shares withheld for employee taxes	—	—	(109,483)	(1)	(9,431)	—	—	—	—	(9,432)
Issuance of common stock to Board of Directors and Scientific Advisory Board	—	—	37,314	—	2,909	—	—	—	—	2,909
Issuance of common stock to employees under an ESPP	—	—	9,730	—	944	—	—	—	—	944
BALANCE, DECEMBER 31, 2017	200,000	2	48,476,034	485	611,063	99,126	(11,464)	1,357,863	(40,158)	659,054
ASC Topic 606 Adoption	—	—	—	—	—	(17,100)	—	—	—	(17,100)
ADJUSTED BALANCE, JANUARY 1, 2018	200,000	2	48,476,034	485	611,063	82,026	(11,464)	1,357,863	(40,158)	641,954
Net income	—	—	—	—	—	58,840	—	—	—	58,840
Other comprehensive income	—	—	—	—	—	—	(4,770)	—	—	(4,770)
Cash dividend	—	—	—	—	—	(11,314)	—	—	—	(11,314)
Issuance of common stock to	—	—	271,068	3	12,136	—	—	—	—	12,139

employees										
Shares withheld for employee taxes	—	—	(108,113)	(1)	(11,619)	—	—	—	—	(11,620)
Common shares repurchased	—	—	—	—	—	—	—	3,774	(477)	(477)
Issuance of common stock to Board of Directors and Scientific Advisory Board	—	—	32,232	—	4,664	—	—	—	—	4,664
Issuance of common stock to employees under an ESPP	—	—	10,303	—	1,090	—	—	—	—	1,090
BALANCE, DECEMBER 31, 2018	200,000	$2	48,681,524	$487	$617,334	$129,552	$(16,234)	1,361,637	$(40,635)	$690,506

The accompanying notes are an integral part of these consolidated financial statements.

UNIVERSAL DISPLAY CORPORATION AND SUBSIDIARIES

CONSOLIDATED STATEMENTS OF CASH FLOWS

(in thousands)

	Year Ended December 31,		
	2018	2017	2016
CASH FLOWS FROM OPERATING ACTIVITIES:			
Net income	$58,840	$103,885	$48,070
Adjustments to reconcile net income to net cash provided by operating activities:			
Amortization of deferred revenue and recognition of unbilled receivables	(68,905)	(11,122)	(7,406)
Depreciation	8,612	4,919	4,270
Amortization of intangibles	21,962	21,983	16,492
Inventory write-down	3,630	—	—
Amortization of premium and discount on investments, net	(6,131)	(2,871)	(1,830)
Stock-based compensation to employees	12,432	12,284	11,374
Stock-based compensation to Board of Directors and Scientific Advisory Board	4,364	2,609	1,715
Change in earnout liability recorded for Adesis acquisition	—	519	—
Deferred income tax (benefit) expense	(12,814)	24,396	3,094
Excess tax benefits from share-based payment arrangements	—	—	(4,232)
Retirement plan benefit expense	4,466	4,351	3,965
Decrease (increase) in assets:			
Accounts receivable	9,226	(27,361)	1,205
Inventory	(37,365)	(18,951)	(4,460)
Other current assets	4,860	(3,884)	(3,870)
Deferred income taxes	20,682	—	—
Other assets	(63,922)	(297)	(133)
Increase (decrease) in liabilities:			
Accounts payable and accrued expenses	1,563	16,420	4,362
Other current liabilities	5,761	(1,917)	4,362
Deferred revenue	130,639	8,402	3,360
Other liabilities	23,896	—	—
Net cash provided by operating activities	121,796	133,365	80,338
CASH FLOWS FROM INVESTING ACTIVITIES:			
Purchases of property and equipment	(25,391)	(29,803)	(7,300)
Purchase of intangibles	—	—	(95,989)
Purchase of business, net of cash acquired	—	—	(33,380)
Purchases of investments	(628,789)	(594,283)	(450,277)
Proceeds from sale of investments	633,179	498,508	548,474
Net cash used in investing activities	(21,001)	(125,578)	(38,472)
CASH FLOWS FROM FINANCING ACTIVITIES:			
Proceeds from issuance of common stock	798	734	439
Repurchase of common stock	(477)	—	—
Proceeds from the exercise of common stock options	—	38	185
Payment of withholding taxes related to stock-based compensation to employees	(11,620)	(9,432)	(4,870)
Excess tax benefits from share-based payment arrangements	—	—	4,232
Cash dividends paid	(11,314)	(5,652)	—
Net cash used in financing activities	(22,613)	(14,312)	(14)

INCREASE (DECREASE) IN CASH AND CASH EQUIVALENTS	78,182	(6,525)	41,852
CASH AND CASH EQUIVALENTS, BEGINNING OF YEAR	132,840	139,365	97,513
CASH AND CASH EQUIVALENTS, END OF YEAR	$211,022	$132,840	$139,365
The following non-cash activities occurred:			
Unrealized gain (loss) on available-for-sale securities	$342	$(19)	$(207)
Common stock issued to Board of Directors and Scientific Advisory Board that was earned and accrued for in a previous period	300	300	300
Common stock issued to employees that was earned and accrued for in a previous period	—	174	1,105
Net change in accounts payable and accrued expenses related to purchases of property and equipment	3,490	4,363	(103)
Earnout liability recorded for Adesis acquisition	—	—	1,670
Excess tax benefits accrued for in other current liabilities	—	—	(4,232)
Cash paid for income tax	17,771	23,248	12,870

The accompanying notes are an integral part of these consolidated financial statements.

UNIVERSAL DISPLAY CORPORATION AND SUBSIDIARIES

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

1. BUSINESS:

Universal Display Corporation (the Company) is a leader in the research, development and commercialization of organic light emitting diode (OLED) technologies and materials for use in display and solid-state lighting applications. OLEDs are thin, lightweight and power-efficient solid-state devices that emit light that can be manufactured on both flexible and rigid substrates, making them highly suitable for use in full-color displays and as lighting products. OLED displays are capturing a growing share of the display market. The Company believes this is because OLEDs offer potential advantages over competing display technologies with respect to power efficiency, contrast ratio, viewing angle, video response time, form factor and manufacturing cost. The Company also believes that OLED lighting products have the potential to replace many existing light sources in the future because of their high power efficiency, excellent color rendering index, low operating temperature and novel form factor. The Company's technology leadership and intellectual property position should enable it to share in the revenues from OLED displays and lighting products as they enter mainstream consumer and other markets.

The Company's primary business strategy is to (1) further develop and license its proprietary OLED technologies to manufacturers of products for display applications, such as mobile phones, televisions, tablets, wearables, portable media devices, notebook computers, personal computers, and automotive interiors, and specialty and general lighting products; and (2) develop new OLED materials and sell existing and any new materials to those product manufacturers. The Company has established a significant portfolio of proprietary OLED technologies and materials, primarily through internal research and development efforts and acquisitions of patents and patent applications, as well as maintaining its relationships with world-class partners such as Princeton University (Princeton), the University of Southern California (USC), the University of Michigan (Michigan) and PPG Industries, Inc. (PPG). The Company currently owns, exclusively licenses or has the sole right to sublicense more than 5,000 patents issued and pending worldwide.

The Company sells its proprietary OLED materials to customers for evaluation and use in commercial OLED products. The Company also enters into agreements with manufacturers of OLED display and lighting products under which it grants them licenses to practice under its patents and to use the Company's proprietary know-how. At the same time, the Company works with these and other companies who are evaluating the Company's OLED technologies and materials for possible use in commercial OLED display and lighting products.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES:

Principles of Consolidation

The consolidated financial statements include the accounts of Universal Display Corporation and its wholly owned subsidiaries, UDC, Inc., UDC Ireland Limited, Universal Display Corporation Hong Kong, Limited, Universal Display Corporation Korea, Y.H., Universal Display Corporation Japan GK, Universal Display Corporation China, Ltd. and Adesis, Inc. (Adesis). All intercompany transactions and accounts have been eliminated.

Business Combinations

Accounting for acquisitions requires the Company to recognize separately from goodwill the assets acquired and the liabilities assumed at the acquisition date fair values. Goodwill as of the acquisition date is measured as the excess of consideration transferred over the net of the acquisition date fair values of the assets acquired and the liabilities assumed. While the Company uses its best estimates and assumptions to accurately value assets acquired and liabilities assumed at the acquisition date as well as contingent consideration, where applicable, the estimates are inherently uncertain and subject to refinement. As a result, during the measurement period, which is when all information necessary is obtained not to exceed one year, adjustments may be recorded to the assets acquired and

liabilities assumed with the corresponding offset to goodwill. Upon the conclusion of the measurement period or final determination of the values of assets acquired or liabilities assumed, whichever comes first, any subsequent adjustments are recorded to the consolidated statements of income.

Management’s Use of Estimates

The preparation of financial statements in conformity with U.S. generally accepted accounting principles (GAAP) requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. The estimates made are principally in the areas of revenue recognition including estimates of material unit sales and royalties, the useful life of acquired intangibles, the use and recoverability of inventories, intangibles and income taxes including realization of deferred tax assets, stock-based compensation and retirement benefit plan liabilities. Actual results could differ from those estimates.

Cash and Cash Equivalents

The Company considers all highly liquid debt instruments purchased with an original maturity of three months or less to be cash equivalents. The Company classifies its remaining investments as available-for-sale. These securities are carried at fair market value, with unrealized gains and losses reported in shareholders' equity. Gains or losses on securities sold are based on the specific identification method.

Trade Accounts Receivable

Trade accounts receivable are stated at the amount the Company expects to collect and do not bear interest. The Company considers the following factors when determining the collectability of specific customer accounts: customer credit-worthiness, past transaction history with the customer, current economic industry trends, and changes in customer payment terms. The Company's accounts receivable balance is a result of chemical sales, royalties and license fees. These receivables have historically been paid timely. Due to the nature of the accounts receivable balance, the Company believes there is no significant risk of collection. If the financial condition of the Company's customers were to deteriorate, adversely affecting their ability to make payments, allowances for doubtful accounts would be required. The allowance for doubtful accounts was $77,000, none and $100,000 at December 31, 2018, 2017 and 2016, respectively.

Inventories

Inventories consist of raw materials, work-in-process and finished goods, including inventory consigned to customers, and are stated at the lower of cost, determined on a first-in, first-out basis, or net realizable value. Inventory valuation and firm committed purchase order assessments are performed on a quarterly basis and those items that are identified to be obsolete or in excess of forecasted usage are written down to their estimated realizable value. Estimates of realizable value are based upon management's analyses and assumptions, including, but not limited to, forecasted sales levels by product, expected product lifecycle, product development plans and future demand requirements. A 12-month rolling forecast based on factors, including, but not limited to, production cycles, anticipated product orders, marketing forecasts, backlog, and shipment activities is used in the inventory analysis. If market conditions are less favorable than forecasts or actual demand from customers is lower than estimates, additional inventory write-downs may be required. If demand is higher than expected, inventories that had previously been written down may be sold.

Property and Equipment

Property and equipment are stated at cost and depreciated on a straight-line basis over the estimated useful life of thirty years for building, fifteen years for building improvements, and three to seven years for office and lab equipment and furniture and fixtures. Repair and maintenance costs are charged to expense as incurred. Additions and betterments are capitalized.

Major renewals and improvements are capitalized and minor replacements, maintenance, and repairs are charged to current operations as incurred. Upon retirement or disposal of assets, the cost and related accumulated depreciation are removed from the consolidated balance sheet and any gain or loss is reflected in other operating expenses.

Certain costs of computer software obtained for internal use are capitalized and amortized on a straight-line basis over three years. Costs for maintenance and training, as well as the cost of software that does not add functionality to an existing system, are expensed as incurred.

Impairment of Long-Lived Assets

Company management continually evaluates whether events or changes in circumstances might indicate that the remaining estimated useful life of long-lived assets may warrant revision, or that the remaining balance may not be

recoverable. When factors indicate that long-lived assets should be evaluated for possible impairment, the Company uses an estimate of the related undiscounted cash flows in measuring whether the long-lived asset should be written down to fair value. Measurement of the amount of impairment would be based on generally accepted valuation methodologies, as deemed appropriate. As of December 31, 2018, Company management believed that no revision to the remaining useful lives or write-down of the Company's long-lived assets was required, and similarly, no such revisions were required for the years ended December 31, 2017 or 2016.

Goodwill and Purchased Intangible Assets

Goodwill is tested for impairment in the fourth fiscal quarter and, when specific circumstances dictate, between annual tests. Company management first assesses qualitative factors to determine whether it is more likely than not that the fair value of a reporting unit is less than its carrying amount as a basis for determining whether a quantitative goodwill impairment test is necessary. If it is concluded it is more likely than not that the fair value of a reporting unit exceeds its carrying amount, then a quantitative impairment

assessment is not necessary. If it is determined that goodwill has been impaired, then its carrying value is written down to fair value. The goodwill impairment test involves a two-step process. The first step, identifying a potential impairment, compares the fair value of a reporting unit with its carrying amount, including goodwill. If the carrying value of the reporting unit exceeds its fair value, the second step would need to be conducted; otherwise, no further steps are necessary as no potential impairment exists. If necessary, the second step to measure the impairment loss would be to compare the implied fair value of the reporting unit goodwill with the carrying amount of that goodwill. Any excess of the reporting unit goodwill carrying value over the respective implied fair value is recognized as an impairment loss. The Company performed its annual impairment assessment as of December 31, 2018 utilizing a qualitative evaluation and concluded that it was more likely than not that the fair value of Adesis (see Note 3) is greater than its carrying value. Company management believes it has made reasonable estimates and assumptions to calculate the fair value of the reporting unit. Future impairment tests will continue to be performed annually in the fiscal fourth quarter, or sooner if a triggering event occurs. As of December 31, 2018, no indications of impairment existed.

Purchased intangible assets with finite lives are carried at cost, less accumulated amortization. Amortization is computed over the estimated useful lives of the respective assets.

Fair Value of Financial Instruments

The carrying values of accounts receivable, other current assets, and accounts payable approximate fair value in the accompanying financial statements due to the short-term nature of those instruments. The Company’s other financial instruments, which include cash equivalents and investments, are carried at fair value.

Fair Value Measurements

Fair value is defined as an exit price, representing the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants based on the highest and best use of the asset or liability. The Company uses valuation techniques to measure fair value that maximize the use of observable inputs and minimize the use of unobservable inputs. Observable inputs are inputs that market participants would use in pricing the asset or liability, and are based on market data obtained from sources independent of the Company. Unobservable inputs reflect assumptions market participants would use in pricing the asset or liability based on the best information available in the circumstances.

Revenue Recognition and Deferred Revenue

Material sales relate to the Company’s sale of its OLED materials for incorporation into its customers’ commercial OLED products or for their OLED development and evaluation activities. Material sales are recognized at the time title passes, which is typically at the time of shipment or at the time of delivery, depending upon the contractual agreement between the parties.

The rights and benefits to the Company’s OLED technology are conveyed to the customer through technology license agreements and material supply agreements. These agreements are combined and the licenses and materials sold under these combined agreements are not distinct from each other for financial reporting purposes and as such, are accounted for as a single performance obligation. Accordingly, total contract consideration is estimated and recognized over the contract term based on material units sold during the period at their estimated per unit fee. Total contract consideration includes fixed amounts designated in contracts with customers as license fees as well as estimates of material fees and royalties to be earned.

Various estimates are relied upon to recognize revenue. The Company estimates total material units to be purchased by its customers over the contract term based on historical trends, industry estimates and its forecast process and related amounts to be charged. Additionally, management estimates the total sales-based royalties based on the

estimated net sales revenue of its customers over the contract term.

Contract research services revenue is revenue earned by Adesis through performing organic and organometallic synthetics research, development and commercialization on a contractual basis. These services range from intermediates for structure-activity relationship studies, reference agents and building blocks for combinatorial synthesis, re-synthesis of key intermediates, specialty organic chemistry needs, and selective toll manufacturing. These services are provided to third-party pharmaceutical and life sciences firms and other technology firms at fixed costs or on an annual contract basis. Revenue is recognized as services are performed with billing schedules and payment terms negotiated on a contract-by-contract basis. Payments received in excess of revenue recognized are recorded as deferred revenue. In other cases, services may be provided and revenue is recognized before the customer is invoiced. In these cases, revenue recognized will exceed amounts billed and the difference, representing amounts which are currently unbillable to the customer pursuant to contractual terms, is recorded as an unbilled receivable.

Technology development and support revenue is revenue earned from government contracts, development and technology evaluation agreements and commercialization assistance fees, which includes reimbursements by government entities for all or a portion of the research and development costs the Company incurs in relation to its government contracts. Revenues are recognized proportionally as research and development costs are incurred, or as defined milestones are achieved, and are included in contract research services in the accompanying consolidated statements of income.

In 2018, the Company entered into a commercial license agreement with Samsung Display Co., Ltd. (SDC). This agreement, which covers the manufacture and sale of specified OLED display materials, was effective as of January 1, 2018 and lasts through the end of 2022 with an additional two-year extension option. Under this agreement, the Company is being paid a license fee, payable in quarterly installments over the agreement term of five years. The agreement conveys to SDC the non-exclusive right to use certain of the Company's intellectual property assets for a limited period of time that is less than the estimated life of the assets.

At the same time the Company entered into the current patent license agreement with SDC, the Company also entered into a new supplemental material purchase agreement with SDC. Under the current supplemental material purchase agreement, SDC agrees to purchase from the Company a minimum amount of phosphorescent emitter materials for use in the manufacture of licensed products. This minimum commitment is subject to SDC’s requirements for phosphorescent emitter materials and the Company’s ability to meet these requirements over the term of the supplemental agreement.

In 2015, the Company entered into an OLED patent license agreement and an OLED commercial supply agreement with LG Display Co., Ltd. (LG Display) which were effective as of January 1, 2015 and superseded the existing 2007 commercial supply agreement between the parties. The new agreements have a term that is set to expire by the end of 2022. The patent license agreement provides LG Display a non-exclusive, royalty bearing portfolio license to make and sell OLED displays under the Company's patent portfolio. The patent license calls for license fees, prepaid royalties and running royalties on licensed products. The agreements include customary provisions relating to warranties, indemnities, confidentiality, assignability and business terms. The agreements provide for certain other minimum obligations relating to the volume of material sales anticipated over the life of the agreements as well as minimum royalty revenue to be generated under the patent license agreement. The Company expects to generate revenue under these agreements that are predominantly tied to LG Display’s sales of OLED licensed products. The OLED commercial supply agreement provides for the sale of materials for use by LG Display, which may include phosphorescent emitters and host materials.

In 2016, the Company entered into long-term, multi-year OLED patent license and material purchase agreements with Tianma Micro-electronics Co., Ltd. (Tianma). Under the license agreement, the Company has granted Tianma non-exclusive license rights under various patents owned or controlled by the Company to manufacture and sell OLED display products. The license agreement calls for license fees and running royalties on licensed products. Additionally, the Company expects to supply phosphorescent OLED materials to Tianma for use in its licensed products.

In 2017, the Company entered into long-term, multi-year agreements with BOE Technology Group Co., Ltd. (BOE). Under these agreements, the Company has granted BOE non-exclusive license rights under various patents owned or controlled by the Company to manufacture and sell OLED display products. The Company has also agreed to supply phosphorescent OLED materials to BOE.

In 2018, the Company entered into long-term, multi-year OLED patent license and material purchase agreements with Visionox Technology, Inc. (Visionox). Under the license agreement, the Company has granted Visionox non-exclusive license rights under various patents owned or controlled by the Company to manufacture and sell OLED display products. The license agreement calls for license fees and running royalties on licensed products. Additionally, the Company expects to supply phosphorescent OLED materials to Visionox for use in its licensed

products.

The Company records taxes billed to customers and remitted to various governmental entities on a gross basis in both revenues and cost of material sales in the consolidated statements of income. The amounts of these pass through taxes reflected in revenues and cost of material sales were $117,000, $409,000 and $171,000 for the years ended December 31, 2018, 2017 and 2016, respectively.

All sales transactions are billed and due within 90 days and substantially all are transacted in U.S. dollars.

See Recent Accounting Pronouncements for discussion of revenue recognition under the new standard, which became effective January 1, 2018.

Cost of Sales

Cost of sales consists of labor and material costs associated with the production of materials processed at the Company's manufacturing partners and at the Company's internal manufacturing processing facilities. The Company’s portion of cost of sales also includes depreciation of manufacturing equipment, as well as manufacturing overhead costs and inventory adjustments for excess and obsolete inventory.

Research and Development

Expenditures for research and development are charged to operations as incurred.

Patent Costs

Costs associated with patent applications, patent prosecution, patent defense and the maintenance of patents are charged to expense as incurred. Costs to successfully defend a challenge to a patent are capitalized to the extent of an evident increase in the value of the patent. Costs that relate to an unsuccessful outcome are charged to expense.

Amortization of Acquired Technology

Amortization costs relate to technology acquired from BASF, Fujifilm and Motorola. These acquisitions were completed in the years ended December 31, 2016, 2012 and 2011, respectively. Acquisition costs are being amortized over a period of 10 years for the BASF and Fujifilm patents and 7.5 years for the Motorola patents.

Amortization of Other Intangible Assets

Other intangible assets from the Adesis acquisition are being amortized over a period of 10 to 15 years. See Notes 3 and 8 for further discussion.

Translation of Foreign Currency Financial Statements and Foreign Currency Transactions

The Company's reporting currency is the U.S. dollar. The functional currency for the Company's Ireland subsidiary is also the U.S. dollar and the functional currency for each of the Company's Asia-Pacific foreign subsidiaries is its local currency. The Company translates the amounts included in the consolidated statements of income from its Asia-Pacific foreign subsidiaries into U.S. dollars at weighted-average exchange rates, which the Company believes are representative of the actual exchange rates on the dates of the transactions. The Company's foreign subsidiaries' assets and liabilities are translated into U.S. dollars from the local currency at the actual exchange rates as of the end of each reporting date, and the Company records the resulting foreign exchange translation adjustments in the consolidated balance sheets as a component of accumulated other comprehensive loss. The overall effect of the translation of foreign currency and foreign currency transactions to date has been insignificant.

Income Taxes

Income taxes are accounted for under the asset and liability method. Deferred tax assets and liabilities are recognized for the future tax consequences attributable to differences between the financial statement carrying amounts of existing assets and liabilities and their respective tax bases and operating loss and tax credit carryforwards. Deferred tax assets and liabilities are measured using enacted tax rates expected to apply to taxable income in the years in which those temporary differences are expected to be recovered or settled. The effect on deferred tax assets and liabilities of a change in tax rates is recognized in income in the period that includes the enactment date. The Company recognizes the effect of income tax positions only if those positions are more likely than not of being sustained. Recognized income tax positions are measured at the largest amount of which the likelihood of realization is greater than 50%. Changes in recognition or measurement are reflected in the period in which the change in

judgment occurs. The Company records interest and penalties, if any, related to unrecognized tax benefits as a component of tax expense.

Share-Based Payment Awards

The Company recognizes in the consolidated statements of income the grant-date fair value of equity based awards such as shares issued under employee stock purchase plans, restricted stock awards, restricted stock units and performance unit awards issued to employees and directors.

The grant-date fair value of stock awards is based on the closing price of the stock on the date of grant. The fair value of share-based awards is recognized as compensation expense on a straight-line basis over the requisite service period, net of forfeitures. The Company issues new shares upon the respective grant, exercise or vesting of the share-based payment awards, as applicable.

Performance unit awards are subject to either a performance-based or market-based vesting requirement. For performance-based vesting, the grant-date fair value of the award, based on fair value of the Company's common stock, is recognized over the service period, based on an assessment of the likelihood that the applicable performance goals will be achieved and compensation expense is periodically adjusted based on actual and expected performance. Compensation expense for performance unit awards with market-based vesting is calculated based on the estimated fair value as of the grant date utilizing a Monte Carlo simulation model and is recognized over the service period on a straight-line basis.

Recent Accounting Pronouncements

In May 2014, the Financial Accounting Standards Board (FASB) issued a new revenue recognition standard entitled Accounting Standards Codification (“ASC”) Topic 606, Revenue from Contracts with Customers. The objective of the standard is to establish the principles that an entity shall apply to report useful information to users of financial statements about the nature, amount, timing, and uncertainty of revenue and cash flows from a contract with a customer. The standard is effective for annual reporting periods beginning after December 15, 2017. The Company adopted the standard beginning January 1, 2018 using the “modified retrospective” approach, meaning the standard was applied only to the most current period presented in the financial statements, with a cumulative adjustment to retained earnings.

The new standard impacts how the Company recognizes revenue on its commercial license and material supply agreements with customers. In addition, the Company previously recognized royalty revenue one quarter in arrears based on sales information received from its customers typically received after disclosing that quarter’s results. Under ASC Topic 606, royalties to be earned over the contract term are estimated as part of total contract consideration and recognized as noted below. The estimates are updated on a quarterly basis.

The rights and benefits to the Company’s OLED technology are conveyed to the customer through technology license agreements and material supply agreements. These agreements are combined and the licenses and materials sold under these combined agreements are not distinct from each other for financial reporting purposes and as such, are accounted for as a single performance obligation. Accordingly, total contract consideration is estimated and recognized over the contract term based on material units sold at its estimated per unit fee.

Adoption of the new standard resulted in an increase in deferred revenue of $21.3 million offset by a reduction of retained earnings of $17.1 million, net of tax of $3.9 million, and unbilled receivables of $0.3 million as of January 1, 2018. The impact of the new standard to revenue for the year ended December 31, 2018 was a decrease of $78.9 million from the amount that would have been recorded under the prior accounting standard. See Note 19 for further discussion.

In February 2016, the FASB issued ASU No. 2016-02, Leases, which addresses the classification and recognition of lease assets and liabilities. The guidance addresses certain aspects of recognition and measurement, and quantitative and qualitative aspects of presentation and disclosure. The guidance is effective for fiscal years beginning after December 15, 2018, including interim periods within those fiscal years. The Company will adopt the standard on January 1, 2019. The Company estimates that adoption of the new standard will result in a reduction in retained earnings of $592,000, net of tax of $157,000, offset by increases in net property and equipment of $7.0 million, other current liabilities of $1.3 million and other liabilities of $6.5 million.

In August 2016, the FASB issued ASU No. 2016-15, Statement of Cash Flows (Topic 230): Classification of Certain Cash Receipts and Cash Payments. The objective of the standard is to reduce diversity in practice in how certain transactions are classified in the consolidated statements of cash flows. The ASU provides additional clarification guidance on the classification of certain cash receipts and payments in the consolidated statements of cash flows. The new guidance is effective for fiscal years and interim periods within those years beginning after December 15, 2017 and did not have any impact on the consolidated financial statements and related disclosures.

In October 2016, the FASB issued ASU No. 2016-16, Income Taxes (Topic 740): Intra-Entity Transfers of Assets Other Than Inventory. ASU 2016-16 clarifies the accounting for the current and deferred income taxes for an intra-entity transfer of an asset other than inventory. ASU 2016-16 is effective for fiscal years beginning after December 15, 2017, including interim periods within those fiscal years, with early adoption permitted. The new guidance is effective for fiscal years and interim periods within those years beginning after December 15, 2017 and did not have any impact on the consolidated financial statements and related disclosures.

In January 2017, the FASB issued ASU No. 2017-04, Intangibles – Goodwill and Other (Topic 350): Simplifying the Test of Goodwill Impairment, eliminating the requirement to calculate the implied fair value, essentially eliminating step two from the goodwill impairment test. The new standard requires goodwill impairment to be based upon the results of step one of the impairment test, which is defined as the excess of the carrying value of a reporting unit over its fair value. The impairment charge will be limited to the amount of goodwill allocated to that reporting unit. The standards update is effective prospectively for annual and interim goodwill impairment testing performed in fiscal years beginning after December 15, 2019, with early adoption permitted. The Company is evaluating the effect that adoption of ASU 2017-04 may have on its consolidated financial statements and related disclosures.

In May 2017, the FASB issued ASU No. 2017-09, Compensation – Stock Compensation (Topic 718): Scope of Modification Accounting. ASU 2017-09 clarifies which changes to the terms or conditions of a share-based payment award require an entity to apply modification accounting, in accordance with Topic 718. The guidance is effective for annual periods beginning after December 15, 2017, with early adoption permitted, and requires a prospective application to awards modified on or after the adoption date. The Company has not historically made changes to the terms or conditions of shared-based payment awards and the adoption of ASU 2017-09, beginning January 1, 2018, did not have any impact on the consolidated financial statements and related disclosures.

3. BUSINESS COMBINATIONS:

On June 23, 2016, the Company entered into an agreement to acquire Adesis, Inc., a privately held contract research organization (CRO) with then 43 employees specializing in organic and organometallic synthetic research, development, and commercialization. Adesis is a technology vendor to companies in the pharmaceutical, fine chemical, biomaterials, and catalyst industries, and had worked with the Company prior to the acquisition to help advance and accelerate a number of the Company's product offerings. The transaction closed on July 11, 2016. Under the terms of the agreement, the Company's subsidiary, UDC, Inc., acquired all outstanding shares of Adesis in a merger for $33.9 million in cash, and up to an additional $2.4 million in cash contingent upon Adesis' achievement of certain milestones within two years of the acquisition. The acquisition was funded through use of existing cash and investments.

Purchase Price Allocation

The Company accounted for Adesis using the acquisition method of accounting in accordance with applicable GAAP whereby the total purchase price was allocated to tangible and intangible assets acquired and liabilities assumed based on respective fair values. The contingent consideration arrangement required the Company to pay up to $1.2 million of additional consideration to the former shareholders of Adesis if revenues exceeded certain threshold levels at the end of each twelve-month period ended December 31, 2016 and December 31, 2017. For both of the years ended December 31, 2017 and 2016, the additional cash consideration earned by the former shareholders of Adesis was $1.2 million. The fair value of the contingent consideration was derived using a Monte Carlo simulation model based on management's projections of future revenue levels. The following table summarizes the values of the assets acquired and liabilities assumed at the date of acquisition (in thousands):

Cash consideration	$33,872
Contingent consideration	1,670
	$35,542
Allocation of purchase price:	
Current assets, including cash of $492	$2,204
Property and equipment	1,869
Accounts payable and accrued liabilities	(906)
Net tangible assets	3,167
Identifiable intangible assets	16,840
Goodwill	15,535
Total purchase price	$35,542

The purchase price exceeded the fair value of the net tangible assets and identifiable intangible assets acquired and, as a result, the Company recorded goodwill in connection with this transaction. This difference includes a going concern element that represents the Company's ability to earn a higher rate of return on this group of assets than would be expected on the separate assets as determined during the valuation process.

Transaction costs of $360,000 were recorded and charged to selling, general and administrative expense on the accompanying consolidated statements of income during 2016.

Intangible Assets Identified

The following table presents the intangible assets identified in the transaction:

Category	Estimated fair value (in thousands)	Estimated useful life (in years)
Customer relationships	$ 10,520	11.5
Developed IP, processes and recipes	4,820	15.0
Trade name/Trademarks	1,500	10.0
Total identifiable intangible assets	$ 16,840	

The fair value of the customer relationships asset was determined using the income approach through an excess earnings analysis which estimates value based on the present value of future economic benefits. The customer relationships intangible asset represents relationships between Adesis and its customers. The fair value of the internally-developed IP, processes and recipes was determined by utilizing the relief-from-royalty methodology. The fair value of the Adesis trade name asset was determined using the income approach through a relief-from-royalty analysis. The determination of useful lives was based upon consideration of market participant assumptions and transaction specific factors.

Impact on Operating Results

The results of Adesis' operations have been included in the Company's consolidated financial statements since the July 11, 2016 date of acquisition. The following unaudited pro forma information assumes the acquisition of Adesis occurred at the beginning of the respective periods presented (in thousands):

	2016
Revenue	$202,547
Net income	44,718

The unaudited pro forma information presented is for illustrative purposes only and does not reflect future events that may occur after December 31, 2018, or any operating efficiencies or inefficiencies that may result from the Adesis acquisition. Additionally, this unaudited pro forma information includes certain one-time costs associated with the Company's integration of the acquired Adesis operations. Therefore, the information is not necessarily indicative of the results that would have been achieved had the business been combined during the periods presented or the results that the Company will experience going forward.

4. CASH, CASH EQUIVALENTS AND INVESTMENTS:

The Company considers all highly liquid debt instruments purchased with an original maturity of three months or less to be cash equivalents. The Company classifies its remaining investments as available-for-sale. These debt securities are carried at fair market value, with unrealized gains and losses reported in shareholders' equity. Gains or losses on securities sold are based on the specific identification method. Investments as of December 31, 2018 and December 31, 2017 consisted of the following (in thousands):

Investment Classification	Amortized Cost	Unrealized Gains	(Losses)	Aggregate Fair Market Value
December 31, 2018				
Certificates of deposit	$ 500	$—	$ (1)	$ 499
Corporate bonds	114,678	1	(19)	114,660
U.S. Government bonds	317,984	14	(43)	317,955
	$ 433,162	$ 15	$ (63)	$ 433,114
December 31, 2017				
Certificates of deposit	$ 1,296	$ 1	$ (1)	$ 1,296
Corporate bonds	104,626	—	(252)	104,374
U.S. Government bonds	214,641	—	(139)	214,502
	$ 320,563	$ 1	$ (392)	$ 320,172

As of December 31, 2018 and 2017, there was none and $17.9 million of corporate bonds, respectively, and $128.8 million and none of U.S. government securities, respectively, included in cash equivalents on the consolidated balance sheet.

5. FAIR VALUE MEASUREMENTS:

The following table provides the assets and liabilities carried at fair value measured on a recurring basis as of December 31, 2018 (in thousands):

	Total carrying value as of December 31, 2018	Fair Value Measurements, Using Quoted prices in active markets (Level 1)	Significant other observable inputs (Level 2)	Significant unobservable inputs (Level 3)
Cash equivalents	$ 139,805	$ 139,805	$ —	$ —
Short-term investments	304,323	304,323	—	—
Long-term investments	—	—	—	—

The following table provides the assets and liabilities carried at fair value measured on a recurring basis as of December 31, 2017 (in thousands):

	Total carrying value as of December 31, 2017	Fair Value Measurements, Using Quoted prices in active markets (Level 1)	Significant other observable inputs (Level 2)	Significant unobservable inputs (Level 3)
Cash equivalents	$ 27,532	$ 27,532	$ —	$ —
Short-term investments	287,446	287,446	—	—
Long-term investments	14,794	14,794	—	—

Level 1 inputs are quoted prices (unadjusted) in active markets for identical assets or liabilities. Level 2 inputs are quoted prices for similar assets and liabilities in active markets or inputs that are observable for the asset or liability, either directly or indirectly through market corroboration, for substantially the full term of the financial instrument. Level 3 inputs are unobservable inputs based on management's own assumptions used to measure assets and liabilities at fair value. A financial asset's or liability's classification is determined based on the lowest level input that is significant to the fair value measurement.

Changes in fair value of the investments are recorded as unrealized gains and losses in other comprehensive income (loss). If a decline in fair value of an investment is deemed to be other than temporary, the cost of the Company's investment will be written down by the amount of the other-than-temporary impairment with a resulting charge to net income. There were no other-than-temporary impairments of investments as of December 31, 2018 or December 31, 2017.

6. INVENTORY:

Inventory consisted of the following (in thousands):

	December 31,	
	2018	2017
Raw materials	$31,203	$17,464
Work-in-process	781	2,977
Finished goods	38,016	15,824
Inventory	$70,000	$36,265

For the year ended December 31, 2018, the Company recorded an inventory write-down of $3.6 million as lower than anticipated customer demand created excess inventory levels in certain products. No inventory write-down was recorded for the years ended December 31, 2017 and 2016.

7. PROPERTY AND EQUIPMENT:
Property and equipment consist of the following (in thousands):

	December 31,	
	2018	2017
Land	$1,006	$1,006
Building and improvements	39,285	24,101
Office and lab equipment	55,333	33,269
Furniture, fixtures and computer related assets	6,941	4,431
Construction-in-progress	12,117	30,011
	114,682	92,818
Less: Accumulated depreciation	(44,943)	(36,368)
Property and equipment, net	$69,739	$56,450

Depreciation expense was $8.6 million, $4.9 million and $4.3 million for the years ended December 31, 2018, 2017 and 2016, respectively.

8. GOODWILL AND INTANGIBLE ASSETS:
The Company monitors the recoverability of goodwill annually or whenever events or changes in circumstances indicate the carrying value may not be recoverable. Purchased intangible assets subject to amortization consist primarily of acquired technology and other intangible assets that include trade names, customer relationships and internally developed IP processes.

Acquired Technology

Acquired technology consists of acquired license rights for patents and know-how obtained from PD-LD, Inc., Motorola, BASF SE (BASF) and Fujifilm. These intangible assets consist of the following (in thousands):

	December 31,	
	2018	2017
PD-LD, Inc.	$1,481	$1,481
Motorola	15,909	15,909
BASF	95,989	95,989
Fujifilm	109,462	109,462
	222,841	222,841
Less: Accumulated amortization	(111,890)	(91,312)
Acquired technology, net	$110,951	$131,529

Amortization expense related to acquired technology was $20.6 million, $20.6 million and $15.9 million for the years ended December 31, 2018, 2017 and 2016, respectively. Amortization expense is included in amortization of acquired technology and other intangible assets expense line item on the consolidated statements of income and is expected to be $20.5 million in each of the years ending December 31, 2019 through 2021, $15.8 million in the year ending December 31, 2022 and $33.6 million thereafter.

Motorola Patent Acquisition

In 2000, the Company entered into a royalty-bearing license agreement with Motorola whereby Motorola granted the Company perpetual license rights to what are now 74 issued U.S. patents relating to Motorola’s OLED technologies, together with foreign counterparts in various countries. The last of the issued U.S. patents expired in 2018.

On March 9, 2011, the Company purchased these patents from Motorola, including all existing and future claims and causes of action for any infringement of the patents, pursuant to a Patent Purchase Agreement. The Patent Purchase Agreement effectively terminated the Company's license agreement with Motorola, including any obligation to make royalty payments to Motorola. The technology acquired from Motorola was amortized over a period of 7.5 years.

Fujifilm Patent Acquisition

On July 23, 2012, the Company entered into a Patent Sale Agreement with Fujifilm. Under the agreement, Fujifilm sold more than 1,200 OLED-related patents and patent applications in exchange for a cash payment of $105.0 million, plus costs incurred in connection with the purchase. The agreement contains customary representations and warranties and covenants, including respective covenants not to sue by both parties thereto. The agreement permitted the Company to assign all of its rights and obligations under the agreement to its affiliates, and the Company assigned, prior to the consummation of the transactions contemplated by the agreement, its rights and obligations to UDC Ireland Limited (UDC Ireland), a wholly-owned subsidiary of the Company formed under the laws of the Republic of Ireland. The transactions contemplated by the agreement were consummated on July 26, 2012. The Company recorded the $105.0 million plus $4.5 million of purchase costs as acquired technology, which is being amortized over a period of 10 years.

BASF Patent Acquisition

On June 28, 2016, UDC Ireland entered into and consummated an IP Transfer Agreement with BASF. Under the IP Transfer Agreement, BASF sold to UDC Ireland all of its rights, title and interest to certain of its owned and co-owned intellectual property rights relating to the composition of, development, manufacture and use of OLED materials, including OLED lighting and display stack technology, as well as certain tangible assets. The intellectual property includes knowhow and more than 500 issued and pending patents in the area of phosphorescent materials and technologies. These assets were acquired in exchange for a cash payment of €86.8 million ($95.8 million). In addition, UDC Ireland also took on certain rights and obligations under three joint research and development agreements to which BASF was a party. The IP Transfer Agreement also contains customary representations, warranties and covenants of the parties. UDC Ireland recorded the payment of €86.8 million ($95.8 million) and acquisition costs incurred of $217,000 as acquired technology, which is being amortized over a period of 10 years.

Other Intangible Assets

As a result of the Adesis acquisition in June 2016, the Company recorded $16.8 million of other intangible assets, including $10.5 million assigned to customer relationships with a weighted average life of 11.5 years, $4.8 million of internally developed IP, processes and recipes with a weighted average life of 15 years, and $1.5 million assigned to trade name and trademarks with a weighted average life of 10 years. At December 31, 2018, these other intangible assets consist of the following (in thousands):

	December 31, 2018		
	Gross Carrying Amount	Accumulated Amortization	Net Carrying Amount
Customer relationships	$10,520	$ (2,228)	$ 8,292
Developed IP, processes and recipes	4,820	(788)	4,032
Trade name/Trademarks	1,500	(368)	1,132
Total identifiable intangible assets	$16,840	$ (3,384)	$ 13,456

Amortization expense related to other intangible assets was $1.4 million, $1.4 million and $615,000 for the years ended December 31, 2018, 2017, and 2016, respectively. Amortization expense is included in amortization of acquired technology and other intangible assets expense line item on the consolidated statements of income and is expected to be $1.4 million for each of the next five fiscal years (2019 - 2023) and $6.4 million thereafter.

Goodwill

As a result of the Adesis acquisition, the Company recorded $15.5 million of goodwill. The Company performs its annual assessment of goodwill during the fourth quarter of the fiscal year unless events suggest an impairment may have been incurred in an interim period. Application of the goodwill impairment test requires the exercise of judgment, including the determination of the fair value of each reporting unit. The Company estimates the fair value of reporting units using an income approach based on the present value of estimated future cash flows. As part of the annual assessment of goodwill completed during the fourth quarter ended December 31, 2018, there were no significant indicators to conclude that an impairment of the goodwill associated with the acquisition of Adesis had occurred.

9. ACCRUED EXPENSES:

Accrued expenses consist of the following (in thousands):

	December 31,	
	2018	2017
Compensation	$13,803	$20,997
Royalties	6,996	9,746
Research and development agreements	3,572	48
Professional fees	655	748
Consulting	527	491
Other	10,504	2,989
	$36,057	$35,019

10. RESEARCH AND LICENSE AGREEMENTS WITH PRINCETON UNIVERSITY, UNIVERSITY OF SOUTHERN CALIFORNIA AND THE UNIVERSITY OF MICHIGAN:

The Company funded OLED technology research at Princeton University and, on a subcontractor basis, at the University of Southern California for 10 years under a Research Agreement executed with Princeton University in August 1997 (the 1997 Research Agreement). The principal investigator conducting work under the 1997 Research Agreement transferred to the University of Michigan in January 2006. Following this transfer, the 1997 Research Agreement was allowed to expire on July 31, 2007.

As a result of the transfer, the Company entered into a new Sponsored Research Agreement with the University of Southern California to sponsor OLED technology research and, on a subcontractor basis, with the University of Michigan. This new Sponsored Research Agreement (as amended, the 2006 Research Agreement) was effective as of May 1, 2006 and had an original term of three years. On May 1, 2009, the Company amended the 2006 Research Agreement to extend the term of the agreement for an additional four years. The 2006 Research Agreement superseded the 1997 Research Agreement with respect to all work being performed at the University of Southern California and the University of Michigan. Payments under the 2006 Research Agreement were made to the University of Southern California on a quarterly basis as actual expenses were incurred. The Company incurred a total of $5.0 million in research and development expense for work performed under the 2006 Research Agreement, which ended on April 30, 2013.

Effective June 1, 2013, the Company amended the 2006 Research Agreement again to extend the term of the agreement for an additional four years. The Company incurred a total of $4.6 million in research and development expense for work performed under the 2006 Research Agreement during the extended term.

Effective May 1, 2017, the Company amended the 2006 Research Agreement once again to extend the term of the agreement for an additional three years. As of December 31, 2018, in connection with this amendment, the Company was obligated to pay the University of Southern California up to $4.1 million for work to be performed during the remaining extended term, which expires April 30, 2020. From May 1, 2017 through December 31, 2018, the Company incurred $1.6 million in research and development expense for work performed under the 2006 Research Agreement.

In connection with entering into the 2006 Research Agreement, the Company amended the 1997 Amended License Agreement to include the University of Michigan as a party to that agreement effective as of January 1, 2006. Under this amendment, Princeton University, the University of Southern California and the University of Michigan have granted the Company a worldwide exclusive license, with rights to sublicense, to make, have made, use, lease and/or sell products and to practice processes based on patent applications and issued patents arising out of work performed under the 2006 Research Agreement. The financial terms of the 1997 Amended License Agreement were not impacted

by this amendment.

On October 9, 1997, the Company, Princeton University and the University of Southern California entered into an Amended License Agreement (as amended, the 1997 Amended License Agreement) under which Princeton University and the University of Southern California granted the Company worldwide, exclusive license rights, with rights to sublicense, to make, have made, use, lease and/or sell products and to practice processes based on patent applications and issued patents arising out of work performed by Princeton University and the University of Southern California under the 1997 Research Agreement. Under this 1997 Amended License Agreement, the Company is required to pay Princeton University royalties for licensed products sold by the Company or its sublicensees. For licensed products sold by the Company, the Company is required to pay Princeton University 3% of the net sales price of these products. For licensed products sold by the Company's sublicensees, the Company is required to pay Princeton 3% of the revenues received by the Company from these sublicensees. These royalty rates are subject to renegotiation for products not reasonably conceivable as arising out of the 1997 Research Agreement if Princeton University reasonably determines that the royalty rates payable with respect to these products are not fair and competitive.

The Company is obligated, under the 1997 Amended License Agreement, to pay to Princeton University minimum annual royalties. The minimum royalty payment is $100,000 per year. The Company recorded royalty expense in connection with this agreement of $7.0 million, $9.7 million, and $5.8 million for the years ended December 31, 2018, 2017, and 2016, respectively.

The Company also is required, under the 1997 Amended License Agreement, to use commercially reasonable efforts to bring the licensed OLED technology to market. However, this requirement is deemed satisfied if the Company invests a minimum of $800,000 per year in research, development, commercialization or patenting efforts respecting the patent rights licensed to the Company.

11. EQUITY AND CASH COMPENSATION UNDER THE PPG AGREEMENTS:

On September 22, 2011, the Company entered into an Amended and Restated OLED Materials Supply and Service Agreement with PPG (the New OLED Materials Agreement), which replaced the original OLED Materials Agreement with PPG effective as of October 1, 2011. The term of the New OLED Materials Agreement ran through December 31, 2015 and shall be automatically renewed for additional one year terms, unless terminated by the Company by providing prior notice of one year or terminated by PPG by providing prior notice of two years. The agreement was automatically renewed through December 31, 2019. The New OLED Materials Agreement contains provisions that are substantially similar to those of the original OLED Materials Agreement. Under the New OLED Materials Agreement, PPG continues to assist the Company in developing its proprietary OLED materials and supplying the Company with those materials for evaluation purposes and for resale to its customers.

Under the New OLED Materials Agreement, the Company compensates PPG on a cost-plus basis for the services provided during each calendar quarter. The Company is required to pay for some of these services in all cash. Up to 50% of the remaining services are payable, at the Company’s sole discretion, in cash or shares of the Company’s common stock, with the balance payable in cash. The actual number of shares of common stock issuable to PPG is determined based on the average closing price for the Company’s common stock during a specified number of days prior to the end of each calendar half-year period ending on March 31 and September 30. If, however, this average closing price is less than $20.00, the Company is required to compensate PPG in cash. No shares were issued for services to PPG for the years ended December 31, 2018, 2017 and 2016.

The Company is also required to reimburse PPG for raw materials used for research and development. The Company records the purchases of these raw materials as a current asset until such materials are used for research and development efforts.

The Company recorded research and development expense of $771,000, $1.7 million and $2.3 million for the years ended December 31, 2018, 2017 and 2016, respectively, in relation to the cash portion of the reimbursement of expenses and work performed by PPG, excluding amounts paid for commercial chemicals.

12. SHAREHOLDERS' EQUITY:

Preferred Stock

The Company’s Articles of Incorporation authorize it to issue up to 5,000,000 shares of preferred stock with designations, rights and preferences determined from time-to-time by the Company’s Board of Directors. Accordingly, the Company’s Board of Directors is empowered, without shareholder approval, to issue preferred stock with dividend, liquidation, conversion, voting or other rights superior to those of shareholders of the Company’s common stock.

In 1995, the Company issued 200,000 shares of Series A Nonconvertible Preferred Stock (Series A) to American Biomimetics Corporation (ABC) pursuant to a certain Technology Transfer Agreement between the Company and ABC. The Series A shares have a liquidation value of $7.50 per share. Series A shareholders, as a single class, have the right to elect two members of the Company's Board of Directors. This right has never been exercised. Holders of the Series A shares are entitled to one vote per share on matters which shareholders are generally entitled to vote. The Series A shareholders are not entitled to any dividends.

As of December 31, 2018, the Company had issued 200,000 shares of preferred stock, all of which were outstanding.

Common Stock

On June 21, 2018, the Company's shareholders approved an amendment to the Company's Amended and Restated Articles of Incorporation to increase the number of authorized shares of the Company's common stock from 100,000,000 to 200,000,000. The amendment was filed with the Pennsylvania Department of State, and became effective on July 17, 2018.

As of December 31, 2018, the Company had issued 48,681,524 shares of common stock, of which 47,319,887 were outstanding. During the year ended December 31, 2018, the Company repurchased 3,774 shares of common stock, now held as treasury stock, for an aggregate purchase price of $477,000.

Scientific Advisory Board and Employee Awards

During the year ended December 31, 2018 and 2017, the Company granted a total of 2,456 and 5,590 shares, respectively, of fully vested common stock to employees and non-employee members of the Scientific Advisory Board for services performed in 2017 and 2016, respectively. The fair value of the shares issued to members of the Scientific Advisory Board was $300,000 for both years ended December 31, 2018 and 2017. No fully vested common stock was issued to employees during 2018 and the fair value of the shares issued to employees during 2017 was $165,000. In connection with the issuance of these employee grants during 2017, 605 shares, with fair value of $55,000, were withheld in satisfaction of employee tax withholding obligations.

Dividends

During the year ended December 31, 2018, the Company declared and paid cash dividends of $0.24 per common share, or $11.3 million, on the Company's outstanding common stock.

On February 21, 2019, the Company's Board of Directors declared a first quarter dividend of $0.10 per share of common stock. Payment of the dividend will be made on March 29, 2019 to shareholders of record at the close of business on March 15, 2019.

13. ACCUMULATED OTHER COMPREHENSIVE LOSS:
Amounts related to the changes in accumulated other comprehensive loss were as follows (in thousands):

	Unrealized gain (loss) on available-for-sale-securities	Net unrealized gain (loss) on retirement plan [2]	Change in cumulative foreign currency translation adjustment	Total	Affected line items in the consolidated statements of operations
Balance January 1, 2016, net of tax	$ (111)	$ (9,708)	$ —	$ (9,819)	
Other comprehensive loss before reclassification	(135)	(1,731)	(65)	(1,931)	
Reclassification to net income [1]	—	1,084	—	1,084	Selling, general and administrative, research and development and cost of material sales
Change during period	(135)	(647)	(65)	(847)	
Balance December 31 2016,	(246)	(10,355)	(65)	(10,666)	

net of tax					
Other comprehensive gain (loss)					
before reclassification	(12)	(2,184)	28	(2,168)	
Reclassification to net income [1]	—	1,370	—	1,370	Selling, general and administrative, research and development and cost of material sales
Change during period	(12)	(814)	28	(798)	
Balance December 31, 2017, net of tax	(258)	(11,169)	(37)	(11,464)	
Other comprehensive gain (loss)					
before reclassification	268	(6,690)	(9)	(6,431)	
Reclassification to net income [1]	—	1,661	—	1,661	Selling, general and administrative, research and development and cost of material sales
Change during period	268	(5,029)	(9)	(4,770)	
Balance December 31, 2018, net of tax	$ 10				