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## Universal Display Corporation Presents OLED Display and Lighting Technology Advances

EWING, N.J.--(BUSINESS WIRE)-- [Universal Display Corporation](#) (Nasdaq: OLED), enabling energy-efficient displays and lighting with its [UniversalPHOLED®](#) technology and materials, today announced OLED technology and material advancements, which include a novel display architecture and a new approach for color tunable phosphorescent white OLED lighting. These advances were highlighted by Universal Display scientists in three separate papers presented earlier today during the [2014 Society for Information Display \(SID\) International Symposium, Seminar, and Exhibition](#).

In an invited paper titled "Color Tunable Phosphorescent White-OLED Lighting Panel", Universal Display's Dr. Michael Weaver presented data on a new approach of fabricating red-green-blue (RGB) monochrome stripes and controlling each of the stripes with separate current drivers. This new method has the potential to improve white OLED lighting panel performance, manufacturing yield, brightness uniformity and color tunability. The latter is a key benefit of solid-state OLED lighting. The paper was co-authored by Dr. Xin Xu, Dr. Huiqing Pang, Dr. Ruiqing Ma, Dr. Pierre-Luc Boudreault, Dr. Alex Dyatkin, Dr. Sean Xia and Dr. Julie Brown and Acuity Brands' Dr. Min-Hao Lu.

In this paper, Dr. Weaver discussed the recent demonstration of a 15 cm x 15 cm color tunable white OLED lighting panel based on an RGB monochrome striped architecture. Using this new architecture, a panel efficacy of 63 lumens per Watt (lm/W) with a correlated color temperature (CCT) of 3,000K at 2,500 cd/m<sup>2</sup> was achieved. Additionally, the company has demonstrated an Energy Star all-phosphorescent warm white OLED with 100 lm/W power efficacy and an LT70 lifetime of 60,000 hours at 1,000 cd/m<sup>2</sup>. Dr. Weaver also reported a remarkable high R9 warm white WOLED with CRI R9 of 96.

By improving white OLED lighting device performance and tunability, Universal Display's PHOLED technology and materials have the potential to meet growing demand for tunable white OLED lighting products. A number of UDC's customers have already previewed these new materials for use in tunable white OLED lighting applications.

Dr. Mike Hack also presented a paper today titled "Novel Two-Mask AMOLED Display Architecture". In the paper, Dr. Hack discussed the pathway for a significant improvement in the lifetime of an OLED display (by as much as 8 times) using a new display architecture that could enhance blue lifetime, thus significantly reducing image sticking. This new AMOLED display architecture may also improve the manufacturability of AMOLED displays, particularly large-area TVs, as well as increase AMOLED display resolution and lifetime, and further reduce device power consumption. The paper was co-authored by Dr. Michael S. Weaver, Dr. Woo-Young So and Dr. Julie Brown.

Dr. Hitoshi Yamamoto presented a paper titled "Understanding Extrinsic Degradation in Phosphorescent OLEDs". In his presentation, Dr. Yamamoto discussed some fundamental results of improving overall PHOLED device technology performance. This work was to study the impact of process conditions during OLED device fabrication. As reported, this study shows that by reducing the existence of impurities, such as water, during fabrication, the device lifetime can be significantly enhanced. The paper was co-authored by Dr. Michael S. Weaver, Dr. Julie Brown, Japan Advanced Institute of Science and Technology's Professor Hideyuki Murata and Kyushu University's Professor Chihaya Adachi.

Additionally, on Tuesday, Bhadri Visweswaran presented a joint symposium paper by Princeton University and Universal Display Corporation titled "Predicting the Lifetime of Flexible Permeation Barrier Layers for OLED Displays". The paper was co-authored by Siddharth Hari Krishna Mohan, Dr. Prashant Mandlik, Jeff Silvernail, Dr. Ruiqing Ma, Dr. Julie Brown, Professor James Sturm and Professor Sigurd Wagner. This paper presents results of a water diffusion study through Universal Display's single-layer barrier encapsulation technology measured with Secondary Ion Mass Spectrometry, electrical capacitance, and mechanical film stress. The time taken for one monolayer of water molecules to permeate into the OLED is defined as the package lifetime. Using this model, it is predicted that a 3 micron thick layer of the company's single layer barrier may have a package lifetime of > 10 years.

"Universal Display is constantly developing and evaluating new methods to support our customers," said Steven V. Abramson, President and Chief Executive Officer of Universal Display. "Our work goes well beyond developing high performance PHOLED materials. We're developing novel ways to improve display and lighting performance and enable lower cost, high yield manufacturing processes to accelerate OLED market growth. We are aggressively targeting numerous areas of development to drive OLED technology further."

Universal Display Corporation has been responsible for key advances in OLED technology for 20 years and continues to be a

global leader in the development, performance and commercialization of OLED technologies. Working with global display manufacturers, Universal Display's PHOLED technologies and materials are currently found in most OLED products on the market. Universal Display is also delivering OLED advances to its partners to help accelerate their commercialization of white OLED lighting and next generation applications, such as flexible OLED products.

To see how Universal Display is changing the face of the display and lighting industries with its UniversalPHOLED, white OLED, and flexible OLED technologies, please visit the company's website at <http://www.udcoled.com>.

## About Universal Display Corporation

Universal Display Corporation (Nasdaq: OLED) is a leader in developing and delivering state-of-the-art, organic light emitting diode (OLED) technologies, materials and services to the display and lighting industries. Founded in 1994, the Company currently owns or has exclusive, co-exclusive or sole license rights with respect to more than 3,000 issued and pending patents worldwide. Universal Display licenses its proprietary technologies, including its breakthrough high-efficiency UniversalPHOLED<sup>®</sup> phosphorescent OLED technology, that can enable the development of low power and eco-friendly displays and white lighting. The Company also develops and offers high-quality, state-of-the-art UniversalPHOLED materials that are recognized as key ingredients in the fabrication of OLEDs with peak performance. In addition, Universal Display delivers innovative and customized solutions to its clients and partners through technology transfer, collaborative technology development and on-site training.

Based in Ewing, New Jersey, with international offices in Ireland, South Korea, Hong Kong, Japan and Taiwan, Universal Display works and partners with a network of world-class organizations, including Princeton University, the University of Southern California, the University of Michigan, and PPG Industries, Inc. The Company has also established relationships with companies such as AU Optronics Corporation, BOE Technology, DuPont Displays, Inc., Innolux Corporation, Kaneka Corporation, Konica Minolta Technology Center, Inc., LG Display Co., Ltd., Lumiotec, Inc., Pioneer Corporation, Samsung Display Co., Ltd., Sony Corporation, and Tohoku Pioneer Corporation. To learn more about Universal Display, please visit <http://www.udcoled.com>.

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