

SID Salutes Industry Standouts

Each year, the Society for Information Display celebrates industry heroes—professionals whose contributions or technical achievements have helped to advance the field. The 2019 recipients of SID honors and awards, who will be recognized during Display Week, include boundary-pushers, educators, and research pioneers. Here, a look at their accomplishments.

By Jenny Donelan

LN displays, as in life, two good rules to follow are stay curious, and don't stay comfortable. Each of the five recipients of major SID Honors and Awards this year has put those principles into practice and allowed a sense of inquisitiveness to drive their careers.

Amal Ghosh, the 2019 Karl Ferdinand Braun Prize winner, was fresh out of grad school and working on printers at IBM (a well-established technology at a well-established company) when he felt drawn to the less-well-established flat-panel technology that his co-workers were researching. Hoi-Sing Kwok, winner of the 2019 Jan Rajchman Prize, was thriving in an optoelectronics-based career in the US when he decided to devote himself to the full-time study of displays in Hong Kong. Dongsheng Wang, this year's David Sarnoff Industrial Achievement Prize recipient, left the CRT business in the 1990s and led his company to success by pursuing a then-emerging technology, TFT LCD. Chain-Shu Hsu, the Slottow-Owaki Prize winner, took perhaps the greatest chance of them all: mentoring successive generations of young researchers as they pass through the university system. And for this year's Peter Brody Prize winner, Hsing-Hung Hsieh, even the relatively untamed frontier of OLEDs was not "wild" enough. With a little encouragement from his professor, he set off to pursue a display technology that had never been studied: oxide TFT.

Today, of course, TFT LCDs are a huge success, and oxide TFT is an established display technology. But someone had to make the decision to take the first step into the

unknown, and this year's winners should be praised for their vision and determination in doing so.

Please join us in congratulating these truly exceptional professionals, as well as our 2019 Fellow and Special Recognition award recipients, for their efforts in the display industry.

2019 Karl Ferdinand Braun Prize

This award is presented for an outstanding technical achievement in, or contribution to, display technology.

Amal Ghosh, an SID Fellow and CTO and senior vice president at eMagin Corp., will receive the Karl Ferdinand Braun Prize for his contributions to the development of OLED microdisplays.

To say that Dr. Ghosh is an active member of SID is an understatement—among other things, he has been the society's secretary,



Amal Ghosh

treasurer, and president; the technical program chair and general chair of Display Week; and the Mid-Atlantic chapter chair. His list of major accomplishments as a scientist is even more extensive. In fact, "Dr. Ghosh was the key enabler behind the shipping of the world's first microdisplay products at eMagin," says Yong-Seog Kim, a past president of SID and professor at Hongik University in South Korea. "His invention of thin-film encapsulation and micro-color patterning technology enabled the OLED microdisplay industry to become a reality and will, I believe, be crucial to the development of AR/VR/MR industries in coming years."

Ghosh's achievements in the area of microdisplays include the development of a process to obtain a tapered-anode structure for proper OLED functioning; the invention and development of key processes for thin-film encapsulation of high-resolution OLED microdisplay devices; recognizing that white OLED with color filters was the easiest route to production; and developing a low-temperature color-filter process for patterning color filters directly on top of OLED devices, which is critical to reducing color cross-talk. Ghosh was also instrumental in developing direct-patterning technology for OLED microdisplays, which led to the fabrication of the world's highest luminance and highest resolution microdisplays.

Born in Pune, India, Ghosh received B.Sc. and M.Sc. degrees from Pune University. After earning his Ph.D. in physics from MIT in 1985, he went on to work for IBM. There, he became intrigued by research that his colleagues were doing in flat-panel displays and eventually gravitated in that direction. In 1995

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Ghosh joined FED Corp. (now eMagin Corp.) where he was instrumental in developing the laser interference lithography used in very low-voltage field-emission display (FED) devices. In 1997, he began working with OLED-on-silicon microdisplays. Ghosh notes that his FED experience was valuable even if that technology is no longer in production. “My early work with FEDs taught me a lot about displays and also some of the processes that are common, e.g. photolithography, etc.,” he says.

When asked which of his many OLED microdisplay achievements he is proudest of, Ghosh points to the development of the thin-film seal. “Since OLEDs are very sensitive to moisture, a very robust seal is a must in order to prevent catastrophic failure,” he notes. “However, there was an additional requirement that the seal be very thin in order to avoid light cross-talk across different colored sub-pixels. The seal I developed satisfied these requirements and really opened the door for very high resolution and very small pixel sizes in OLED-on-silicon microdisplays.”

The next challenge for the OLED microdisplay industry, according to Ghosh, is to take the devices into mainstream commercialization, whether in enterprise or consumer applications, or both. The time, he says, is right: “The advent of AR/VR is creating an altogether different market for microdisplays, and OLED microdisplays are most ideally suited for such applications.”

As for SID, Ghosh describes his involvement with the society as “technologically very enlightening” and helpful in terms of networking. It has introduced him, and eMagin, to “the brightest and most powerful folks in the industry,” he says.

2019 Jan Rajchman Prize

This award is presented for an outstanding scientific or technical achievement in, or contribution to, research on flat-panel displays.

Hoi-Sing Kwok, an SID Fellow and past Slottow-Owaki winner, will receive the Jan Rajchman Prize for his contributions to LCD science and technology, and particularly to photoalignment technology and bistable displays. He is director of the State Key Laboratory of Advanced Displays and Optoelectronics and the Dr. William Mong Chair of Nanotechnology at the Hong Kong University of Science and Technology.

Dr. Kwok enjoyed a successful academic



Hoi-Sing Kwok

and scientific career in laser spectroscopy and thin-film optoelectronics research before he ever began his work with displays. He obtained his Ph.D. in applied physics from Harvard University in 1978 and taught at the State University of New York at Buffalo from 1980 to 1992. He was named a US White House Presidential Young Investigator in 1984 and received the New York State Excellence Award in 1991. In 1992, he returned to Hong Kong to become chair professor at Hong Kong University of Science and Technology (HKUST). It was there that he turned his full attention to displays. “When I moved back to Hong Kong after teaching for 12 years in the US, I wanted to change to something practical. I picked display technology since it fit my previous work in optoelectronics,” says Kwok. He adds that he was lucky that HKUST had excellent display research facilities. “I had no problem getting started right away.”

Since then, Kwok has been extraordinarily prolific, with more than 700 display-related papers and more than 90 patents to date, representing years of display research. He has made major contributions to the field of LCOS microdisplays, including placing a color filter onto the silicon backplane and inventing a reflective LCD mode design. He has also worked with bistable displays, contributing to the science and technology of nematic LCD bistability. Moreover, he has made major strides in the areas of nanoalignment and photoalignment of LC molecules. Kwok was one of the earliest contributors to the field of liquid-crystal on-silicon (LCOS) microdisplays, starting in 1995. In 2001, he founded Integrated Microdisplays (iMD) to commercialize

the results. That company and its IP were purchased by Himax Display in 2007.

Kwok’s contributions do not end with his professional work. “He is also a key player in the display community, especially in China,” says Frank Yan, director of SID’s Beijing Chapter and a distinguished professor at Fuzhou University. “Professor Kwok is the director for SID’s Hong Kong Chapter and the main contributor to most display-related activities in China. He has devoted a lot of effort toward organizing display conferences there.”

“People say display technology is mature and that there is not much new to do. This is not true,” Kwok says. “There are always new materials and new approaches, from TFTs to display modes. In fact, as the display industry becomes larger, the impact of your research becomes greater.”

2019 David Sarnoff Industrial Achievement Prize

The David Sarnoff Industrial Achievement Prize is designed to honor an individual who is broadly recognized across the display industry for having achieved exceptional leadership and long-lasting impact in the display industry.

Dongsheng Wang, the chairman and founder of BOE Technology Group Co., Ltd., will receive the David Sarnoff Industrial Achievement Prize for his leadership in reshaping the display industry through mass production in China.

Truly great businesspeople seem to have in common not only a talent for organizing, leading others, and synthesizing information from



Dongsheng Wang

disparate areas of their company, but a real passion for and understanding of what their business makes and sells. Dongsheng Wang is the gold standard for this kind of executive. He thinks on a high level—in fact he created a “Survival Law,” also called “Wang’s Law,” for the display industry that states that panel-performance metrics must be doubled (at least) every 36 months for a given price point. But he is also able to discuss the finer aspects of display technology, as noted by Julie Brown, the chief technical officer and senior vice president of Universal Display Corporation. The first time she met him, she was struck by his knowledge of OLED technology. “His driving questions showed his unique skill to focus in on key points. This is a unique characteristic for a leader responsible for founding and building such a large business,” Brown says.

Wang was born in Shaoxing, China, and attended Hangzhou Dianzi University, where he earned a degree in finance and accounting. He also earned an M.S. in Management Engineering from the University of Electronic Science and Technology of China. Upon graduation, he worked at Beijing Electronic Tube Factory for 12 years before founding BOE in 1993. Under his leadership, BOE has become a leading company, not only in China but in the global display industry.

Wang recalls the early days: “When BOE was founded in the mid-1990s, it produced primarily CRT components—the CRT TV industry was prospering in China,” he says. Then, when flat-panel displays emerged, “most companies did not realize that the CRT would be replaced, but I sensed opportunities.” In 1994, BOE created a research team to study flat-panel technology, as well as the internet, which was growing at the time. Wang’s group looked at plasma, field emission, and TFT-LCD technologies. “Few people thought of TFT-LCD, because it would be a huge investment and the technology was difficult. It was a really hard choice! I spent a long time studying the history of the electronics industry, and I discovered that, ever since the invention of the transistor in 1947, semiconductor technology has eventually replaced vacuum electronic technology. Based on this finding, we chose TFT-LCD, which was based on semiconductor technology.” The company launched its strategic plan in 1998 and officially entered the TFT-LCD display field in 2003, after years of preparation.

Wang says the biggest challenge of his

career has been the “rollercoaster-like” cyclical fluctuations of the TFT-LCD industry, which began almost as soon as BOE stepped into the display business. BOE’s solution has been to improve its technological strength—constantly and quickly. “We attach great importance to R&D input, which accounts for over 7 percent of annual revenue,” says Wang. “And we stick to the philosophy that there are only weak products and not weak markets, and that innovation is always the key.” In the Internet of Things era, the challenge is still enormous, he adds. “Display devices will no longer be for display functions only. They will be the information exchange interfaces in the ecological chain of the Internet of Things, which will be bidirectional and intelligent. This requires global eco-chain partners to work together, make innovations in an open manner, and collaborate to achieve a win-win situation.”

2019 Slottow-Owaki Prize

The Slottow-Owaki Prize is awarded for outstanding contributions to the education and training of students and professionals in the field of information displays.

Chain-Shu Hsu, a chair professor at the National Chiao Tung University, will receive the Slottow-Owaki Prize for his contributions to education in display science and technology.

In the last three decades, Dr. Hsu has supervised 30 Ph.D. students, 110 M.S. students, and 10 post-doctoral scholars. Many of these former students have gone on to enter the display industry or academia, becoming impor-



Chain-Shu Hsu

tant contributors to the advancement of display technology. When asked about the educational philosophy behind all of this mentorship, Dr. Hsu offers a quote attributed to Albert Einstein: “ ‘It’s not that I’m so smart, it’s just that I stay with problems longer.’ This reflects my thoughts about working with students very well,” he says. “I tell them to be persistent and to be careful with the results they collect—both are very important to one’s success.”

Hsu has also been involved in display research for more than 30 years. He is a pioneer researcher in liquid-crystal and organic light-emitting diode materials. His research team at National Chiao Tung University has developed room-temperature liquid crystals featuring high refractive indices, and he has developed nematic fluorinated liquid crystals over a wide range of temperatures, as well as UV-curable liquid crystalline monomers. A large portion of this work has been transferred to commercialization.

Hsu was born in Yunlin, Taiwan. He received a B.S. from National Taiwan Normal University in 1975 and an M.S. from National Tsinghua University in 1978. After earning a Ph.D. in macromolecular science from Case Western Reserve University in 1987, he was then recruited to teach at National Chiao Tung University in Taiwan. Hsu’s Ph.D. thesis had focused on the synthesis of novel side-chain liquid-crystalline polymers and the development of materials with tailorable properties. When he joined National Chiao Tung University, his career began with synthesizing fluorinated liquid crystals for display applications. “Liquid-crystalline materials are of great importance to the display industry,” says Hsu. “I was also attracted by the fantastic, colorful textures of liquid-crystal phases.” At the university, Hsu organized an LCD research team with three professors from the departments of photonics, electronic engineering, and material science and engineering. This team went on to complete many industry-academia collaborative research projects, in conjunction with Uni-pac Optoelectronics Corp.

From 1989 to 2000, Hsu organized workshops every year to promote LCD research in Taiwan. He also founded the Taiwan Liquid Crystal Society in 1995 and served as its president from 2009 to 2011.

“Aside from his knowledge and professional skills, I am inspired by Professor Hsu’s personality,” says Sheng Hsiung-Yang, a former student and associate professor at

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National Chiao Tung University at Tainan campus. “He is energetic and tirelessly ambitious in terms of new scientific research. Moreover, he is a kind and selfless person, always willing to groom succeeding generations.”

Although he clearly enjoys research, Hsu says he decided early on in his career that he found it most rewarding to be an academic, since it allowed him to make an impact on many students and foster their growth. “Liquid-crystal displays are a highly interdisciplinary field, and I always encourage my students to be creative, innovative, and hungry for knowledge because you never know when you will need it,” Hsu says.

2019 Peter Brody Prize

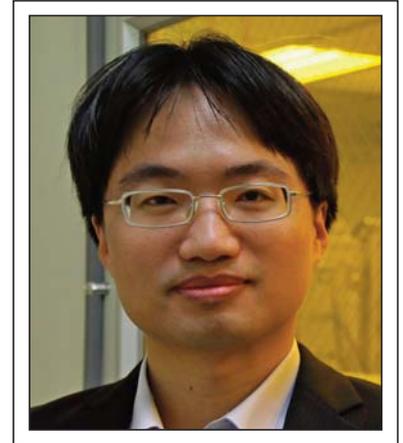
The Peter Brody Prize is awarded to honor outstanding contributions of researchers under age 40 who have made major-impact technical contributions to the developments of active-matrix addressed displays in one or more of the following areas:

- Thin-film transistor devices

- Active-matrix addressing techniques
- Active-matrix device manufacturing
- Active-matrix display media
- Active-matrix display enabling components

Hsing-Hung Hsieh, a display architect at HP, has won the Peter Brody Prize for his contributions to oxide-TFT displays and mass production of AMOLED.

It wasn't so long ago that oxide TFT was a brand-new technology for the display industry. That it is well established now is due to researchers like Dr. Hsieh, who gamely took on the unknown about 15 years ago. In the early 2000s, Hsieh opted to focus on displays for his graduate work at National Taiwan University, where he had also earned a B.S. in electrical engineering, and an M.S., and Ph.D. in electronics engineering. Though many of his peers pursued the more mature field of semiconductors, Dr. Hsieh says he was drawn to displays because they represent the intersection of so many areas of technology. “I like to explore new ideas,” he says, “and displays connect many new ideas.”



Hsing-Hung Hsieh

Hsieh chose to study with SID Fellow Chung-Chih Wu, a professor at National Taiwan University, thinking he would pursue OLEDs, for which Wu is well known. But Wu suggested instead that Hsieh look at oxide TFT, which hadn't been explored. That idea appealed to Hsieh, so much so that he went on

2019 SID Fellow Awards

The grade of Fellow is conferred upon SID members of outstanding qualifications and experience as scientists or engineers whose significant contributions to the field of information display have been widely recognized. This year's Fellows include:



Poopathy Kathirgamanathan, for his contributions to charge-transport materials for OLED displays and lighting. Dr. Kathirgamanathan is chair professor in electronic materials engineering at Brunel University. He earned his Ph.D. in physical chemistry from Exeter University.



Yi-Pai Huang, for his contributions to the development of LC devices for 3D/AR/VR applications and to a novel field-sequential-color driving method. Dr. Huang is a professor and the director of the Display Center at National Chiao-Tung University. He received a Ph.D. in electro-optical engineering from National Chiao-Tung University.



Sungchul Kim, for his contributions in achieving mass production in AMOLED displays. Dr. Kim is executive vice president and head of the OLED business unit at Samsung Display Co. He has a Ph.D. in physics from Kyung Hee University.



Tomokazu Shiga, for his contributions to local-dimming technology. Dr. Shiga is an associate professor with the department of engineering science at the University of Electro-Communications. He received his Ph.D. in electronic engineering from the University of Electro-Communications.



Shihchang (James) Chang, for his contributions to in-cell touch, LTPS, and oxide-TFT technologies for display applications. Chang is a senior director at Apple, Inc. He earned an M.S. in chemical engineering from National Central University.

to make a career out of that technology.

In 2008, he was recruited by AUO to kick off its oxide-TFT project and its application for AMOLED. Later, he became manager of AUO's OLED Technology Center, in charge of TFT backplane technologies (including LTPS and oxide TFTs) for both AMOLED mass production and novel AMOLED applications (such as transparent, flexible, mirror, and combination displays). In 2013, he joined Polyera as the director of its Advanced Device Development Division, where he established and managed multinational R&D activities for flexible oxide TFTs, flexible AMOLED displays, and novel organic light-emitting transistor (OLET) displays. Since 2017, he has been a display architect at HP, investigating novel display technologies for commercial laptops.

"Although Dr. Hsieh is a young researcher,

he has had an outstanding career and has made great contributions to the display industry," says Professor Hyun Jae Kim of the Department of Electrical and Electronic Engineering at Yonsei University. He notes that Hsieh has produced about 100 journal and conference papers and has more than 80 patents granted or pending in the US, China, and Taiwan.

"It was very tough in the beginning because there were no papers, no research. I needed to figure out what materials to use and try them myself," says Hsieh. "For many years, I felt lonely, like I was the only one in the world studying this topic that I wasn't even sure would work. I needed to keep faith." His advice to other scientists toiling away on subjects only they seem to care about: "Don't be afraid to fail, and don't be afraid to explore your own interests, because you do have second chances." ■

The 2019 honorees will receive their awards at the SID Honors & Awards

Banquet, which takes place at

7:30 pm, Monday, May 13, during Display Week at the Fairmont Hotel

in San Jose. Tickets are \$100 each and must be purchased in advance.

www.displayweek.org

2019 SID Special Recognition Awards

Presented to members of the technical, scientific, and business community at large for distinguished and valued contributions to the information-display field.



Chiwoo Kim, for his contributions to the process development of a-Si TFT LCDs, LTPS LCDs, and flexible AMOLED displays. Dr. Kim is president and group CTO at APS Holdings. He earned his Ph.D. in condensed matter physics at the University of Texas at Austin.



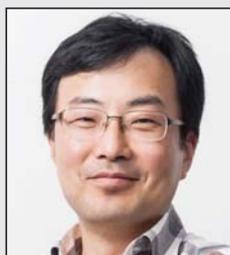
Jinh Kwag, for his contributions to the development of integrated on-cell touch and edge-type AMOLED displays. Dr. Kwag is executive vice president and head of the Display Research Center at Samsung Display. He received a Ph.D. in solid-state physics from Seoul National University.



Seung-Woo Lee, for his contributions to the electronics and driving techniques for display applications. Dr. Lee is a professor at Kyung Hee University. He earned a Ph.D. in electrical engineering from Korea Advanced Institute of Science and Technology (KAIST).



Xiaogang Peng, for his contributions to the development of solution-processable quantum dots for display applications. Dr. Peng is a National Scholar and a professor of chemistry at Zhejiang University. He earned a Ph.D. in chemistry from Jilin University.



Soo-Young Yoon, for his contributions to the development of advanced OLED TVs. Dr. Yoon is the director of the LG Display Laboratory. He received a Ph.D. in physics from Hanyang University.