EDITORIAL

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Preface to Special Issue on Advanced Optoelectronic and Electronic Devices toward Future Displays

——Celebration of the 10th anniversary of the State Key Laboratory of Advanced Displays and Optoelectronics Technologies at HKUST

Hoi-Sing Kwok[1, 2, †] and Zhiyong Fan[1, 2, †]

[1]Department of Electronic and Computer Engineering, The Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong SAR, China

[2]State Key Laboratory of Advanced Displays and Optoelectronics Technologies, HKUST, Clear Water Bay, Kowloon, Hong Kong SAR, China

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This year marks the tenth anniversary of the State Key Laboratory of Advanced Displays and Optoelectronics Technologies (SKLADOT) at the Hong Kong University of Science and Technology (HKUST). The predecessor of SKLADOT was the Center for Display Research (CDR) which was started in 1995. Thus display research has a long history at HKUST. Display research is necessarily multidisciplinary combining advances in optics and electronics. In the beginning, we concentrated mainly on liquid crystal displays (LCD) and thin film transistors (TFT) research. They were the key technologies responsible for the explosive growth of active matrix high definition liquid crystal displays around the end of the 90's and at the beginning of the 21st century. Later, areas in organic light emitting diode (OLED) and quantum technologies were added to our repertoire. However, regardless of the mode of light emission or light modulation, TFT remains the backbone of any modern electronic display. TFT provides active matrix control and is essential for high resolution and high contrast ratios. In the beginning, TFTs were made of amorphous silicon (a-Si). Later, polycrystalline silicon was developed. In fact, low temperature polycrystalline silicon (LTPS) and a-Si are still being used in the production of large flat panel displays nowadays. However, it is believed that metal oxide (MO) TFT will eventually replace both of them. It is because MOTFT has a simple and low cost production process as a-Si and high mobility approaching that of LTPS TFT.

At SKLADOT, we conduct extensive research on MOTFT. In this special anniversary issue, we have invited past and present members of SKLADOT to present their results on TFT research. Other papers related to semiconductor technologies are also included. The Special Issue starts with a review paper by Runxiao Shi *et al.* describing the MOTFT technology developed at HKUST[1]. It also describes the numerous applications in flexible TFT based biomedical devices. Feilian Chen *et al.* review MOTFT made with a novel material ITZO, which promises high mobility[2]. Yanxin Wang *et al.* report a method to enhance the stability and lifetime of IGZO MOTFT[3]. Stability is the main issue in preventing the widespread deployment of MOTFT. With the demonstration of fluorination providing excellent stability, it is believed that MOTFT will become even more important in the future.

As mentioned, besides TFT, there are other areas of semiconductor research being carried out at SKLADOT. These areas include organic light emitting diode (OLED) as well as QLED based on quantum dots. The paper by Bryan Tam *et al.* describes a new way to produce high resolution OLED using close space sublimation[4]. The paper by Xiangwei Qu and Xiaowei Sun[5], as well as the paper by Depeng Li *et al.*[6] review and report the development in quantum dot based QLEDs. Another important organic-inorganic hybrid material that is gaining attention is perovskite. It has some interesting properties that make this material quite attractive. M. Qammar *et al.* describe the application of perovskite in making memristors[7]. Zhenghao Long *et al.* present data on using perovskites as image sensors[8]. They were able to produce nanowires of perovskite for neuromorphic imaging, which is very promising. Semiconductor quantum rods were discussed in the paper by Wanlong Zhang *et al.*[9]. Fascinating alignment effects were observed making use of a technique developed for LCD alignment. It demonstrates the usefulness of cross disciplinary research. Finally, the Special issue ends with a review on gallium oxide power devices by Man Hoi Wong[10].

Certainly, there are a lot of areas of research that we have omitted in this Special Issue. For example, there is a whole area of micro-LED that is very actively pursued at HKUST. These omissions are necessary or else the Special Issue will be too lengthy. The papers presented here are just a glimpse of the diverse research being performed at SKLADOT at HKUST. We thank the authors of these papers for their efforts in presenting their works as well as presenting reviews of the various fields. As mentioned, the principal authors are present members of SKLADOT or graduates who have maintained collaborations with their alma mater. As the past founding and present Directors of SKLADOT, we are grateful to our members and alums for their contributions.

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Correspondence to: H S Kwok, eekwok@ust.hk; Z Y Fan, eezfan@ust.hk
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Hoi-Sing Kwok obtained his PhD from Harvard University in 1978. He taught at the State University of New York at Buffalo from 1980 to 1992 and became Full Professor in 1985. In 1992 he returned to Hong Kong to become Chair Professor at Hong Kong University of Science and Technology. He is currently Executive Director of the State Key Laboratory of Advanced Displays and Optoelectronics Technologies. He won the SID Slottow-Owaki Prize in 2014 and the SID Rajchman Prize in 2019. He is an Elected Member of the National Academy of Inventors, Hong Kong Academy of Engineering Sciences and the Asia-Pacific Academy of Materials. He is also a Fellow of IEEE, Society for Information Displays (SID) and Optica (Optical Society).

Zhiyong Fan is a Chair Professor at the Department of Electronic and Computer Engineering. He received B.S. and M.S. degrees from Fudan University, PhD degree from University of California, Irvine in 2006 then worked as a postdoctoral fellow at UC Berkeley and Lawrence Berkeley National Laboratory. He joined Hong Kong University of Science and Technology (HKUST) in 2010. Currently, he is the Co-director of the State Key Laboratory of Advanced Display and Optoelectronics Technologies at HKUST. He is a Fellow of the Royal Society of Chemistry, Fellow of Optica, Senior Member of IEEE, and Founding Member of the Young Academy of Sciences of Hong Kong. He is an Associate Editor of Journal of Semiconductors. His research interest is focused on functional nanomaterials and structures for electronic, optoelectronic and bionic electronic devices.