Guest Editorial

FLEXIBLE electronics is a technology for fabricating or assembling electronic devices on mechanically flexible substrates comprised of polymers, organic–inorganic hybrids, thin glasses, or metals. This technology provides the opportunity to create energy-efficient products that are lightweight, ultrathin, and rugged in large area and novel form factors. There has been an explosion of interest in flexible electronics over the past few years; nowadays flexible electronics technology is being actively developed for applications in flexible displays for e-book and eposter applications, radio frequency identification tags, solid-state lighting and solar cells, sensors, and a host of revolutionary devices that have not been dreamed of yet.

This Special Issue highlights some of the recent developments in flexible electronics technology, covering flexible displays, thin-film transistors (TFTs), organic light-emitting diodes (OLEDs), sensors, etc. Most of the papers in this issue were presented at the 2007 International Symposium for Flexible Electronics and Displays (ISFED-2007), organized by the Industrial Technology Research Institute (ITRI), Taiwan, Organic Electronics Association (OE-A) and National Tsing Hua University, Taiwan. This symposium, initiated by ITRI, was successful in bringing together scientists and engineers actively engaged in research, development and manufacturing of flexible electronics to discuss current progresses in this exciting field. All contributed papers in this issue have been reviewed in accordance with the normal procedures of the JOURNAL OF DISPLAY TECHNOLOGY.

The papers in this Special Issue address key issues in selective topics of flexible electronics and displays. Here the readers will find technological innovations on writable cholesteric liquid crystal displays (by D. W. Lee *et al.*), larger-area flexible sensors (by Y.-C. Lin *et al.*), multicolor polymer-dispersed microencapsulated liquid crystal displays (by K.-F. Chen *et al.*) and blue flexible transparent OLED devices (by T. Uchida *et al.*). Fundamental research relating to TFT development has been presented here, including the fabrication of transparent ZnO TFT on glass and plastic substrates using a post-sputtering oxygen passivation technique (by J. J. Huang *et al.*), the control of the performance of organic TFT by electrode and device structure (by C.-H. Yu *et al.*), and the systematic study of the effects of mechanical strain on the mobility of polycrystalline silicon TFT (by P.-C. Kuo *et al.*). Other original reports include the self-tunable cell-library design for low power and reliable flexible electronics (by T. C. Huang and K.-T. Cheng), fabrication of polymer inverter by inkjet printing on flexible substrate (by H. C. Chen *et al.*), development of an innovative voltage driving pixel circuit using organic TFT for AMOLED displays (by P.-T. Liu and L.-W. Chu). A new method for fabricating a pure liquid crystal structure using a thermal annealing process that effectively expels the residual monomers from the LC volume was shown to considerably enhance the optical properties of the devices (by S. J. Hwang *et al.*). The two papers on the developments of carbon nanotubes-reinforced conductors for flexible electronics (by J. Tsai and H. Hwang) and the high-energy gap OLED host materials for green and blue PHOLED (by C.-J. Lin *et al.*) represent progress on key materials for realizing the applications of flexible electronics.

As the innovation of flexible electronics technology relies heavily on multidisciplinary collaboration over a broad range of fundamental subjects, we do recognize that a single issue with 13 contributed papers is far from enough to cover all the key issues and topics in this field. We nonetheless hope that this issue may serve as a useful model for a type of forum for discussing the latest frontiers in both fundamental research and technological development of the rapidly growing field of flexible electronics and displays. Finally, we would like to express our gratitude to the former Editor-In-Chief of the JOURNAL OF DISPLAY TECHNOLOGY, Professor Shin-Tson Wu, for providing us the opportunity to organize this Special Issue.

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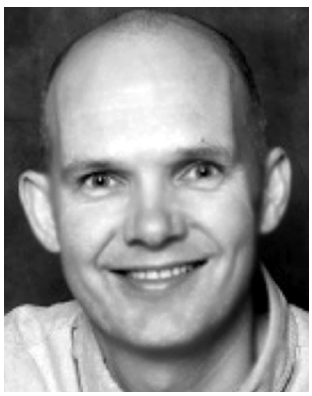
Hsin-Lung Chen received the diploma in chemical engineering from Ming-Chi Institute of Technology, Taipei, Taiwan, and the Ph.D. degree in polymer science and engineering from the University of Massachusetts, Amherst, in 1994.

He is currently the Tsing Hua Chair Professor of the Department of Chemical Engineering, National Tsing Hua University, Hsinchu, Taiwan. His research interests center on the self-organization behavior of nanostructured polymers, including light-emitting conjugated polymers, block copolymers and electrostatic complexes of DNA. He has over 90 peer-reviewed publications.

Dr. Chen served as the coordinator of the Polymer Science and Engineering Program of the National Science Council (NSC) of Taiwan from 2006 to 2008, and from 2007 to 2008 he was also the coordinator of the Interdisciplinary Projects of Flexible Electronics sponsored by NSC. He was the chair of the Technical Program Committee of the 2007 International Symposium on Flexible Electronics and Displays (ISFED-2007). Since 1998 he has served as the Associate Editor of the *Journal of Polymer Research*.

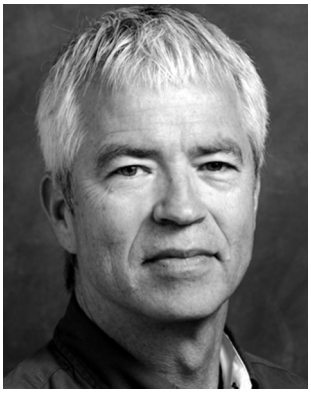
Jack Hou was born in Taipei, Taiwan, in 1962. He received the B.S. degree from National Taipei Institute of Technology, Taipei, Taiwan, in 1983, and the M.S. and Ph.D. degrees in polymer science and engineering from Lehigh University, Philadelphia, PA, in 1991

From 1991 to 2001, he worked for the CopyTele, Inc. as a lead researcher. From 2001–2005, he worked for Sipix Imaging, Inc. as a Senior Director for electronic paper development. He joined the Industrial Technology Research Institute (ITRI), Hsinchu, Taiwan, in 2001. Presently, he is the Director of Flexible Electronics Technology Division at EOL/ITRI. His main research interests include display system integration, display materials and manufacturing processes.



Iain McCulloch received the Ph.D. degree in polymer chemistry at the University of Strathclyde, Strathclyde, U.K., in 1989.

Following his degree, he then joined Hoechst Celanese, in the US, engaged in the research of novel functional polymers for nonlinear optics, lithography and drug delivery. Before joining Imperial, he was a Research Manager at Merck Chemicals, U.K., from 2000 to 2007, responsible for novel solution processable organic semiconductor materials for application in organic field effect transistors and photovoltaic devices. He is currently Professor of Polymer Materials in the Department of Chemistry at Imperial College London, U.K., a director and co-founder of Flexink Ltd., and a partner of C-Change LLP. His research interests are in the design, synthesis and application of conjugated materials for optical and electronic applications. He has edited one book, and co-inventor of over 50 patents and co-author of over 100 papers and three book chapters. His webpage is at: http://www3.imperial.ac.uk/people/i.mcculloch.



Gregory B. Raupp received the Ph.D. degree from the University of Wisconsin in 1984.

He is currently a Professor of Chemical Engineering at Arizona State University (ASU), and an active researcher in application areas that span many engineering disciplines, from electrical engineering/materials science applications in flexible electronics and displays, microelectronics and packaging, to bioengineering applications in biocompatible and "smart" responsive coatings. He has over 120 publications and 3 U.S. patents in these fields. In 1999 he was appointed Associate Dean for Research in the College of Engineering and Applied Science (CEAS), and in 2002 he was appointed Associate Vice President for Research for the university. During his three year term as Associate Dean the college enjoyed a 60% growth in research expenditures. In his VP role he was responsible for crafting and managing ASU's multimillion dollar research investment portfolio spanning the focus areas of Bio-, Info-, Nano-, and Manufacturing Technologies; Earth, Space, and Environmental Science; Public Policy; Social and Behavioral Sciences; and Fine Arts and the Humanities. In February 2004 he became the Founding Director for the new University-led Flexible Display Center at ASU. In December 2008 he became the Director of the Strategic Materials Research Initiative, Office of the Vice President for Research and Economic Affairs, ASU, where he will continue to work with the FDC to market their capability and expand their fundamental research portfolio.

Vivek Subramanian (SM'94–M'98) received the B.S. degree in electrical engineering from Louisiana State University in 1994, and the M.S. and Ph.D. degrees in electrical engineering from Stanford University, Palo Alto, CA, in 1996 and 1998, respectively.

He co-founded Matrix Semiconductor, Inc., in 1998. Since 1998, he has been with the University of California, Berkeley, where he is currently an Assistant Professor in the Department of Electrical Engineering and Computer Sciences. His research interests include CMOS devices and technology and polysilicon thin-film transistor technology for displays and vertical integration applications. His current research focuses on organic electronics for display, low-cost logic, and sensing applications. He has authored more than 50 research publications and patents.

Dr. Subramanian has served on the technical committee for the Device Research Conference and the International Electron Device Meeting. In 2002, he was nominated to Technology Review's list of top 100 young innovators (the TR100), and his work at Matrix Semiconductor was nominated to the Scientific American SA50 list for visionary technology. In 2003, he was awarded a National Science Foundation Young Investigator Award (CAREER).