EDITORIAL

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Preface to the Special Issue on Semiconductor Optoelectronic Integrated Circuits

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The past 20 years have witnessed the rapid growth of photonic integration circuits (PIC) technology, which has been warmly embraced by both academia and the industry. Powered by the advanced development in material growth, processing, and design capability, the PIC technology now covers multiple material platforms, including III–V (InP, GaAs), silicon, silica, lithium niobate on insulator (LNOI) polymer, etc. The integration level has evolved from a single functional device to thousands of components on-chip. The increase in the performance and the complexity of the PICs have become an energetic booster for communication and information technology.

To reflect the recent advances in the PICs, we organized a special issue on semiconductor optoelectronic integrated circuits. The special issue includes eight invited reviews and three research articles, focusing on the development of key devices and technologies in mainstream PIC platforms. Hao Sun *et al.* review the recent progress on integrated electro-optic frequency comb generators reported on the InP, $LiNbO_2$, and silicons platforms. Mengxi Tan *et al.* review recent work on broadband RF channelizers based on integrated optical frequency Kerr micro-combs combined with passive micro-ring resonator filters. Swapnajit Chakravarty *et al.* reviews the existing integration strategies of III–V materials and present a route towards hybrid integration of both III–V and ferroelectrics on the same chip. Shuai Yuan *et al.* review the latest developments in the LNOI platform, covering ultra-high-speed electro-optic modulators, optical frequency combs, opto-electro-mechanical system on a chip, second-harmonic generation in periodically poled LN waveguides, and efficient edge coupling for LNOI. Mengxi Tan *et al.* review their recent work on fixed and tunable orthogonally polarized optical single sideband (OSSB) generators as well as a dual-channel RF equalizer, based on integrated dual polarization micro-ring resonators. Three reviews are dedicated to the light sources. Jianou Huang *et al.* review the directly modulated laser (DML) for short-reach applications, elaborating the data rate demands and technical standards of the data centers and 5G fronthaul networks, as well as the technical routes and achievements of recent DMLs. Songtao Liu and Akhilesh Khope review the recent progress of the high-performance lasers and amplifiers on silicon-based on different technology, including ultra-narrow linewidth III–V/Si lasers, fully integrated III–V/Si/Si_3N_4 lasers, high-channel-count mode-locked quantum dot (QD) lasers, and high gain QD amplifiers. Chanchan Luo *et al.* review the technologies to the state-of-the-art progress of waveguide-based external cavity narrow linewidth semiconductors. Additionally, three research articles are contributed to cover the areas of integrated light sources, micro-ring-based signal generation, and high-frequency characterization techniques. Lianping Hou *et al.* report a low-cost manufacturing approach for fabricating monolithic multi-wavelength sources for dense wavelength division multiplexing (DWDM) systems. Yuhua Li *et al.* report a silicon-nanocrystal embedded high-index doped silica micro-ring resonator to increase its nonlinearity. Mengke Wang *et al.* report a self-referenced and ultra-wideband high-frequency characterization of a high-speed MZM and PD in an optical link based on low-speed photonic sampling.

We sincerely hope this special issue could provide a valuable overview and reference for the readers. We would like to thank all the authors for their outstanding contributions to this special issue. We are also grateful to the editorial and production staff of Journal of Semiconductors for their assistance.

Wei Wang is a professor of Institute of Semiconductors, Chinese Academy of Sciences. He graduated from the Department of Physics, Beijing University in 1960. His research interests include DFB lasers, VCSEL, electro-absorption modulated lasers and other InP based Photonic Integrated Circuits. Professor Wang is an elected Academician of the Chinese Academy of Sciences.

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Weiping Huang received his Ph.D. in 1989 from MIT in electrical engineering. He was a professor of University of Waterloo and then McMaster University, Canada. He also worked at Nortel (Canada) and NTT (Japan) and consulted with several companies in North America and Asia. He founded Apollo Photonics Inc. to develop software design tools for photonic integrated circuits in 1995. He co-founded Hisense Broadband Multimedia Technologies Inc. in 2003, and the company is now a leading supplier of optical transceivers ranking No. 3 globally in 2020. He is Chairman of Qingdao Hisense Broadband Multimedia Technology Co. He also is the dean, School of Information Science and Engineering, Shandong University. He is internationally known for his contributions and expertise for photonic devices and integrated circuits.

Yong Liu is a Professor at the University of Electronic Science & Technology of China (UESTC). He received his Ph.D. degree from Eindhoven University of Technology in 2004, and stayed at the same university as a researcher. Since 2007, he became a professor at UESTC. He received Chinese National Science Fund for Distinguished Young Scholars in 2009 and Chinese Chang Jiang Scholar in 2013. His research interests are mainly focused on high-speed optoelectronic devices and optical fiber technologies.

Brent Little received his Ph.D. in Electrical Engineering and Advanced Mathematics from the University of Waterloo, Canada in 1994. He has held research potions at MIT, University of Maryland, Infinera, and Fujitsu. In 2000 he was the founder and CTO Little Optics Inc. Currently he is a visiting professor at the Xian Institute of Optics and Precision Mechanics of CAS in Xian, China, as well as the co-founder and CTO of QXP Technologies Inc. He has been a pioneer in photonics and optical telecommunications, having co-authored more than 400 journal publications, and holding more than 50 patents.