GUEST EDITORIAL

Novel Semiconductor Quantum Devices Shaping Our Century

CAN BAYRAM

THE RESPONSIBLE MANAGEMENT of energy resources is an important concern. Effective measures for better management of energy resources are urgently needed as the world's population increases and prosperity reaches more people. Novel semiconductor quantum devices hold the promise of enabling more-efficient energy conversion, the production of cheap and energy-saving integrated photonics, and reliable global connectivity and communication. Researchers across the world are racing to develop technologies that could potentially be worth billions of dollars and create hundreds of thousands of new jobs at all levels in society. However, even as the world economy grows, our planet is in peril, as the media constantly reminds us. One material class, the III-As/P/N semiconductors, may hold the key to both efficiently managing resources and saving our planet.

In this issue, "Molecular Beam Epitaxy of III-Nitride Nanowires," by S. Zhao, Renjie Wang, Sheng Chu, and Zetian Mi, provides a new road map for developing low-dimensional building blocks to improve emitter efficiency. They discuss the challenges and prospects of such nanowires for future electronic and photonic devices, including micro-LEDs, deep ultraviolet light emitters, and solar fuel and artificial photosynthesis devices.

Digital Object Identifier 10.1109/MNANO.2019.2893033
Date of publication: 20 March 2019

"Heterogeneously Integrated InP/Silicon Photonics," by Richard Jones, Pierre Doussiere, Jeffrey B. Driscoll, Wenhua Lin, Haijiang Yu, Yulia Akulova, Tin Komljenovic, and John E. Bowers, describes how a combination of commercial heterointegration methods are being used to attack global connectivity and communication problems. They confront the issues head on by complementing existing silicon photonics programs with integrated III–V lasers and transmitters.

One material class, the III-As/P/N semiconductors, may hold the key to both efficiently managing resources and saving our planet.

Optical transmission, detection, and information processing with a single device requires that device to be both optically and electrically active. With this in mind, "Transistor Laser–Integrated Photonics for Optical Logic," by Ardy Winoto, Junyi Qiu, Dufei Wu, and Milton Feng, provides a compelling case for new photonic device technology, the quantum-well transistor laser. This device serves as a viable, reconfigurable optical switching technology platform for beyond-CMOS computing. These novel semiconductor quantum devices may fulfill the future energy and communication needs in this ever-expanding networked world.