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Editorial

Semiconductors: Materials, Physics, and Devices

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The Si, GaAs, and InP based semiconductor devices have improved our lives significantly during the last century. Wide-bandgap semiconductors, such as ZnO, SiC, GaN, Ga_2O_3, and diamond, are believed to be the next generation semiconductors because of their excellent physical and chemical properties. These semiconductors are promising candidates for fabrication of optoelectronic devices and semiconductor electronics, such as light emitters, solar cells, solar blind detectors, high-power electronics, gas sensors, high-power microwave transistors, and microelectromechanical system (MEMS). In order to fabricate high-performance semiconductor electronic and optoelectronic devices, several research fields are being developed, such as high quality bulk or epitaxial layer growth, *n*-type and *p*-type doping, surface crystal quality improvement, interface quality of metal/semiconductor or insulator/semiconductor junctions, optimization of device fabrication processes, and new application development for the semiconductor devices. During recent few years, significant progresses in semiconductor growth and device technology have been developed. It would be valuable and meaningful to realize the research situations of them.

In this special issue, A. Maerz et al. gave a general description of the thermal behavior of vertical SiC metal-oxide-semiconductor field-effect transistor (MOSFET) under various driving and boundary conditions in case of a short-circuit event. The accurate prediction of the SiC MOSFET withstanding time for single fault events greatly influences the requirements for device protection circuits for these devices in power converter applications, like voltage-source-inverters or power-electronic-transformers. For this reason a thermal model based on the structural design, the physical dimensions of the chip, and material properties of 4H-SiC is proposed. R. Banchuin analyzed random variation in subthreshold floating-gate MOSFET (FGMOSFET). The analysis of random variation in the performance of FGMOSFET which is an often cited semiconductor based electronic device, operated in the subthreshold region defined in terms of its drain current, has been proposed. C.-I. Lee et al. investigated noise parameters of silicon germanium (SiGe) heterojunction bipolar transistors (HBTs) for different sizes in the breakdown region for the first time. Good agreement between experimental and simulated noise performance at breakdown is achieved for different sized SiGe HBTs. The presented analysis can benefit the RF circuits operating in the breakdown region. H. Lim et al. gave a review about the modeling of magnetic tunnel junction (MTJ). Modeling methods and models of MTJ characteristics are classified into two groups, macromodels and behavioral models, and the most important characteristics of MTJs. A. Hariya et al. demonstrated considerations of physical design and implementation for wide regulation range MHz-level LLC resonant DC-DC converters with gallium nitride high electron mobility transistors. The physical parameters and size of the planar transformer are optimized by using derived equations and finite element method with Maxwell 3D.

We hope this special issue could provide the readers with an overview of the recent achievements in the field of semiconductor based materials, physics, and devices. We also hope that this special issue could provide a valuable reference for semiconductor researchers.

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