Active and Passive Electronic Components

Special Issue on
Novel Devices Based on 2D Materials

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The continuous improvement of integrated circuits promotes the success of the semiconductor industry. This great achievement can undoubtedly be attributed to the continuous size reduction of electronic devices. However, further reduction in device dimensions will soon lead to a tremendous rise in power consumption as well as limited gain in the performances of integrated circuits. In this respect, two-dimensional (2D) materials, such as graphene, dichalcogenides, and buckled nanocrystals, offer the possibility of downscaling the channel thickness at the atomic level, which could lead to much improved electrostatic control of the device and suppression of the short channel effects. Moreover, these 2D materials usually possess direct and tunable bandgaps and excellent electrical, optical, mechanical, and thermal properties. This unique set of desirable properties of 2D materials has triggered great interest in developing ultrathin 2D electronic devices, ranging from realizing better material quality and simplified fabrication processes to improving device performance and expanding the application horizon.

With the discovery of hexagonal boron nitride, some 2D materials are now in place to advance integrated flexible nanoelectronics, which produce a new generation of low-cost, high-performance, transparent, exible, and wearable devices for ubiquitous flexible systems. Several other 2D materials have also shown advantages in charge transport and light absorption over traditional semiconductor materials used in photovoltaic devices. Also, benefiting from the unique physical and chemical properties, some 2D layered materials have shown great potential in fabricating sensing devices. To date, a larger number of novel devices based on 2D materials have been explored, including field effect transistors, optoelectronics, electronic sensors, wearable devices, supercapacitors, and electrochemical energy storage devices. Though great achievements in the applications of 2D materials in devices have been reported, numerous challenges still remain. For practical applications, the device performance should be further improved by optimizing the 2D material synthesis, film transfer, surface functionalization, and chemical/physical doping processes.

The purpose of this special issue is to present the state of recent progress in the field, including methods to realize a better quality of 2D materials, new fabrication processes on 2D materials and devices, novel 2D devices, and new applications of 2D devices. The special issue covers various aspects of theoretical and experimental researches related to 2D material based devices. We also welcome review submissions which describe the current state of the novel devices based on 2D materials.

Potential topics include but are not limited to the following:

- Field effect transistors built from 2D materials in sensing
- 2D materials for photovoltaic devices
- Applications of 2D materials in photoelectric detectors
- 2D components for energy harvesting
- Magnetic devices based on 2D materials
- Applications of 2D materials in electronic skin and wearable sensors
- 2D semiconductors for flexible devices
- 2D MOSFETs for ultralow power logic applications operating with low supply voltages
- 2D field effect transistor (FET), heterojunction devices, and tunnel diode 2D materials for optoelectronic components

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Submission Deadline
Friday, 13 April 2018

Publication Date
August 2018