

Interface and surface control of 2D MoS₂-based nanoelectronic devices

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Transition metal dichalcogenide (TMD) two-dimensional (2D) atomic layered materials have recently drawn considerable attention as promising semiconductors for future ultrathin layered nanoelectronic device applications. Unlike graphene, TMD materials have a semiconductor band gap, for example, molybdenum disulfide (MoS₂) that has been widely studied is known to have a direct band gap of ~1.9 eV as a single MoS₂ layer and an indirect band gap of ~1.2 eV as a bulk MoS₂ crystal.

In this talk, I will review our group research works on MoS₂-based nanoelectronic devices. In particular, I explain the following topics on the electrical properties of MoS₂ FETs; (1) effect by the environments such as oxygen and water, (2) gate bias stress-dependent device instability, (3) interface control by high energetic proton beam irradiation, (4), large area synthesis and direct patterning of single-layer MoS₂ film and device application, and (5) surface treatment by molecules for sulfur vacancy passivation of MoS₂.

Biography:

Takhee Lee is currently a Professor in Department of Physics and Astronomy, Seoul National University (SNU), Korea. He received his B.S. and M.S. degree in physics at Seoul National University, Korea in 1992 and 1994, respectively, and he received his Ph.D. degree in physics at Purdue University, USA in 2000. He was a postdoctor in the Department of Electrical Engineering, Yale University, USA until 2004. He was a faculty in Department of Materials Science and Engineering, Gwangju Institute of Science and Technology, Korea until 2011. His current research at SNU is characterization of the electrical properties of structures involving single molecules, self-assembled monolayers, polymers, semiconductor nanomaterials, and their assembly into electronic devices. He has edited 2 books, written 10 book chapters, 11 review articles, and more than 220 journal articles. He was awarded with Outstanding Research Award in SNU (2014), Best Thesis Advisor Award in Physics in Korea (2012), Korean Scientist of the Month Award (2010), Korea Prime Minister Award (2010), and Korea Minister of Education, Science and Technology Awards (2008, 2010). He is currently Editorial Board Members in ACS Nano, Nanotechnology, Advanced Electronic Materials, and Flexible and Printed Electronics journals.