

K.U
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제33회 한림국제심포지엄

Fundamental Properties and Applicability of the Carbon Nanostructures

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Major Activities

- | | |
|--------------|--|
| 1994 | Ph.D., Department of Physics, Ohio State University, USA |
| 1994-1995 | Postdoc., Department of Physics, Ohio State University, USA |
| 1995-present | Assistant, Associate, and Full Professor, Department of Physics, Korea University, Korea |
| 2001, 2012 | Visiting Professor, Department of Physics, Ohio State University, USA |
| 2007-2012 | Director of National research Lab (NRL) for Hybrid Nanostructures |
| 2008-2016 | Regional Editor of Synthetic Metals |
| 2015-present | Fellow, The Korean Academy of Science and Technology (KAST) |

Honors or Awards

- | | |
|------|---|
| 2006 | Hyundai-KIA Chaired Professor in Natural Science |
| 2008 | National R&D 100 Excellent Research Award (KISTEP) |
| 2008 | National Research Award (Korea Research Foundation) |

Research Interests

Nanoscale optical and electrical properties of organic hybrid nanostructures, Photoresponsive nano-devices using organic hybrid nanostructures, Characterization and optoelectronic devices for two-dimensional van der Waals systems, Plasmonics and nanophotonics of hybrid nanostructures, Bio-sensing using hybrid nanostructures, Charge transport of conducting polymers, Electromagnetic interference shielding

Multifunctional Optoelectronic Nano-Devices Using Two-Dimensional Inorganic/Organic Van Der Waals Hybrids: Photovoltaic Fets

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Organic crystalline *p*-type rubrene (or tetracene) thin film with excellent optical absorption was partially hybridized with a few-layer (or monolayer) *n*-type MoS₂ having high mobility through van der Waals interaction. Nanoscale optical characteristics of the MoS₂/rubrene and MoS₂/tetracene hybrids were investigated using a high-resolution laser confocal microscope (LCM). Two-dimensional (2-D) lateral-type *n-p* hetero-junction field-effect-transistors (FETs) using the MoS₂/rubrene and MoS₂/tetracene hybrids exhibited both gate-tunable diode and anti-ambipolar transistor (i.e., coexistence of *n*-type and *p*-type charge carrier mobilities) characteristics. The FETs also had two distinguishable on-states and off-states depending on the gate bias, applying to a four-state transistor. From photocurrent mapping experiments, the gate-bias-dependent photovoltaic effect was observed for the hetero-junction regions of the MoS₂/rubrene FETs. Eventually, the photovoltaic FETs were successfully operated by light irradiation without source-drain bias and controlled using gate bias. These devices represent new solar-energy-driven 2-D multifunctional optoelectronic devices. A monolayer (or a few-layer) *n*-type MoS₂ layers was also hybridized with the perovskite CsPbBr₃ quantum dots (QDs). From LCM photoluminescence and Raman spectra, the *n*-type doping effect from the perovskite QDs to MoS₂ layers was observed. The charge carrier mobility and photoresponsivity of the FETs using the MoS₂/CsPbBr₃-QDs hybrids were drastically enhanced due to the *n*-type doping effect, in comparison with the pristine MoS₂ FETs.

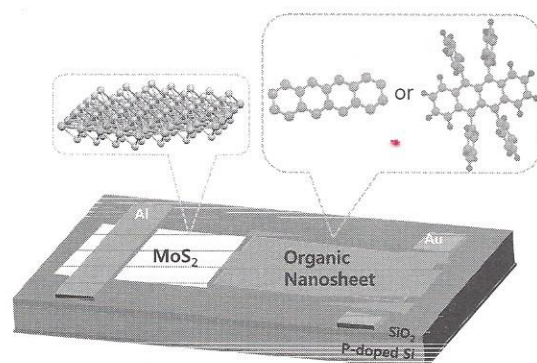


Figure 1 Schematic illustration of MoS₂/Organic hybrid device

33rd KAST International Symposium

Fundamental Properties and Applicability of the Carbon Nanostructures

Time	Contents
16:30-16:50	Two-dimensional materials: physics and applications Marija Drndic (University of Pennsylvania, USA)
16:50-17:10	Bioassay based on magnetic nanoparticles with microfluidic sample handling and high-Tc SQUID readout Dag Winkler (Chalmers University of Technology, Sweden)
17:10-17:30	Air-Liquid Interfacial Self-Assembly of Conjugated Block-Copolymers and Nanoparticles So Jung Park (Ewha Womans University, Korea)
17:30-17:50	3D Nano/Micro Structures Fabricated by Two-Photon-Initiated Polymerization for Photonic and Biophotonic Applications Kwang Sup Lee (Hannam University, Korea)
17:50-18:10	Introducing p-type and n-type paired conjugated polyelectrolytes for efficient charge collection in polymer solar cells Kwanghee Lee (GIST, Korea)
18:10-19:00	Break
19:00-21:00	Dinner (Banquet)

PROGRAM July 1st

Paradise Hotel Busan, Sicily Room

Time	Contents
Session 3	Low Dimensional Nano Electronics Chair: Sang Wook Lee (Professor, Ewha Womans University)
09:00-09:30	STM and Gas Phase Studies of Li@C60 Eleanor E. B. Campbell (University of Edinburgh, UK)
09:30-09:50	Carbon nanotube fibre-metal composite with a high current-carrying capacity Dong Su Lee (KIST, Korea)
09:50-10:10	Research towards new architecture based on 2D layered materials Sung Ho Jhang (Konkuk University, Korea)
10:10-10:30	Electro active composite materials for supercapacitors Carita Kvarnström (University of Turku, Finland)
10:30-10:50	Multifunctional optoelectronic nano-devices using two-dimensional inorganic/organic van der Waals hybrids: Photovoltaic FETs Jinsoo Joo (Korea University, Korea)
10:50-11:10	Coffee break
11:10-11:40	Inducing Spin-orbit interaction in graphene by single atomic layer of transition-metal dichalcogenides Helene Bouchiat (University of Paris-sud, France)
11:40-12:00	Strong proximity coupling in vertical and planar graphene-based Josephson junctions Hu-Jong Lee (POSTECH, Korea)
12:00-12:20	Topological excitations in 1D and 2D charge density wave systems Han Woong Yeom (IBS Center for Artificial Low Dimensional Electronic Systems, POSTECH, Korea)
12:20-12:40	High performance quantum dot light-emitting diodes by improving the charge balance Changhee Lee (Seoul National University, Korea)
12:40-13:00	Recent Research Achievements on Nano-materials in Samsung Advanced Institute of Technology Sungwoo Hwang & Eunjoo Jang (Samsung Advanced Institute of Technology, Korea)
13:00-14:00	Lunch