Vol. 2

2021.04.15.

KIT Energy News

에너지융합기술 혁신인재 양성사업단

Innovative Education & Research Center for Energy Convergence Science and Technology

kit 국립금오공과대학교 Kumoh National Institute of Technology

NRF 한국연구재단

BrainKorea21 FOUR

< 목　　차 >

에너지저장

에너지변환

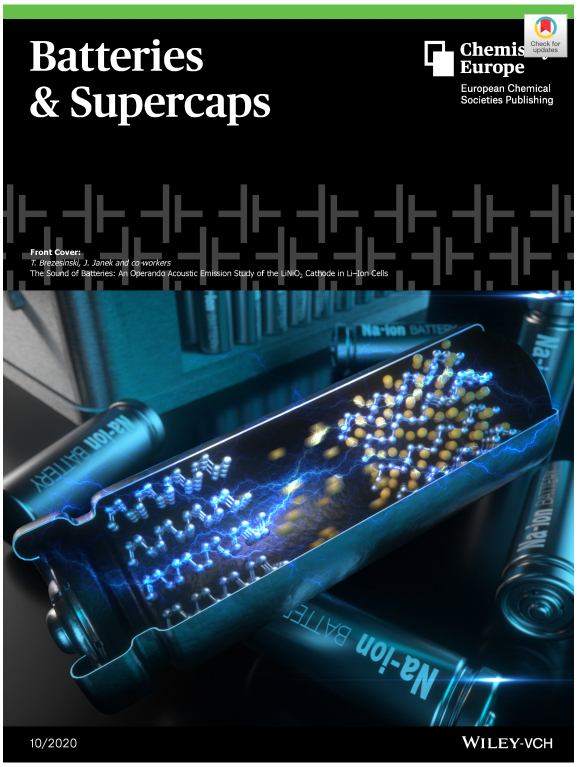
태양에너지

에너지저장

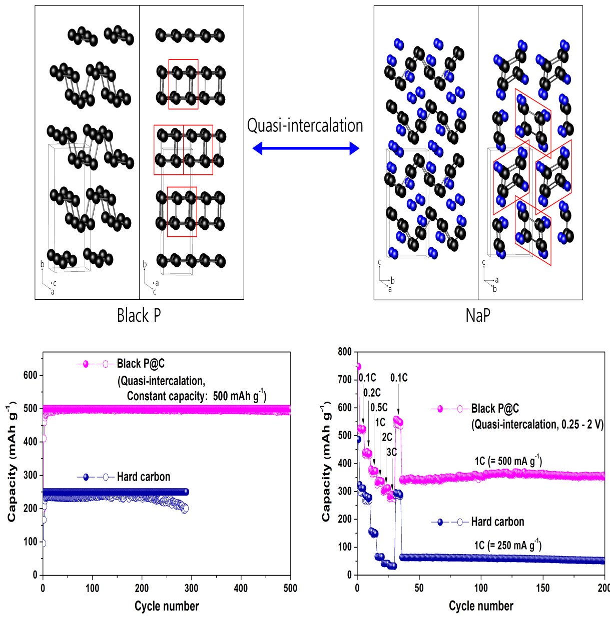
Batteries & Supercaps
329, January 2021, p112-119 (Impact Factor: *New Journal*)

Sodium Quasi-Intercalation in Black P for Superior Sodium-Ion Battery Anodes

Tae-Hyun Kim and Cheol-Min Park*



Denoted as cover & VIP
(VIP: Very Important Paper)



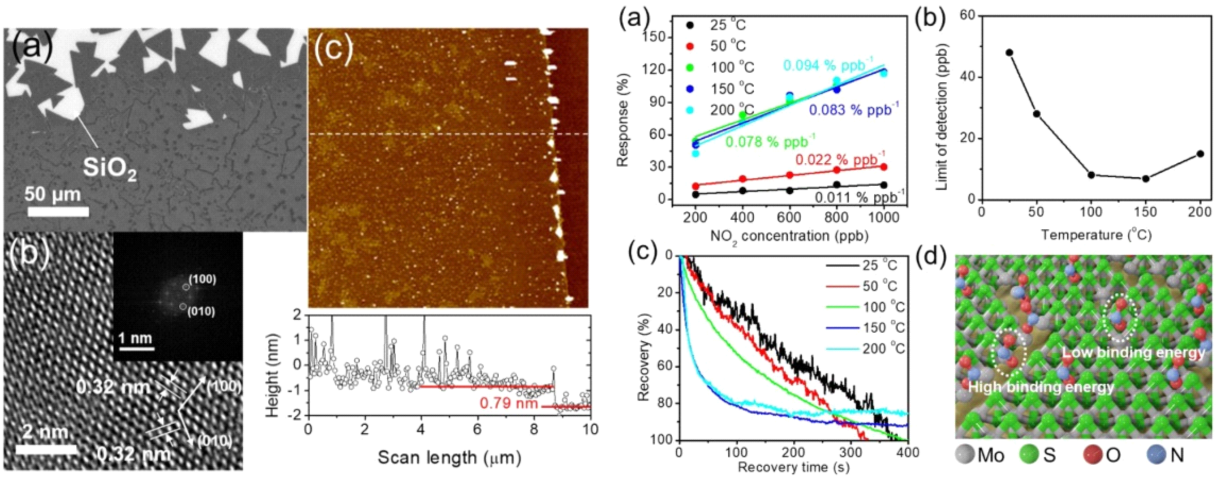
Herein, a Na quasi-intercalation concept in black P is developed in order to achieve superior P-based Na-ion battery (NIB) anodes. Firstly, black P with a puckered layer structure is synthesized via a simple solid-state reaction using commercially available red P. Additionally, an amorphous carbon modified black P nanocomposite (black P@C) is prepared to optimize its electrochemical Na reversibility. Furthermore, the Na reaction pathways of black P are demonstrated using various ex situ analytical tools. During sodiation/desodiation, black P undergoes the two-step reactions of sequential quasi-intercalation of NaP formation (at 0.25 V) and conversion of Na_3P formation (at 0 V). Interestingly, black P@C shows poor cycling performance when using the conversion reaction, but it shows superior performance when using the quasi-intercalation reaction between black P and NaP. Therefore, we anticipate that the Na quasi-intercalation in black P@C will lead to high-performance NIB anod.

에너지변환

Sensors and Actuators: B. Chemical
329, February 2021, p129138 (Impact Factor: 7.100)

Insight into mechanism of temperature-dependent limit of NO_2 detection using monolayer MoS_2

Tri Khoa Nguyen, Sangmin Jeong, Jong-Sang Youn, Seungbae Ahn, Ki-Hun Nam, Ki-Joon Jeon*, Cheol-Min Park*



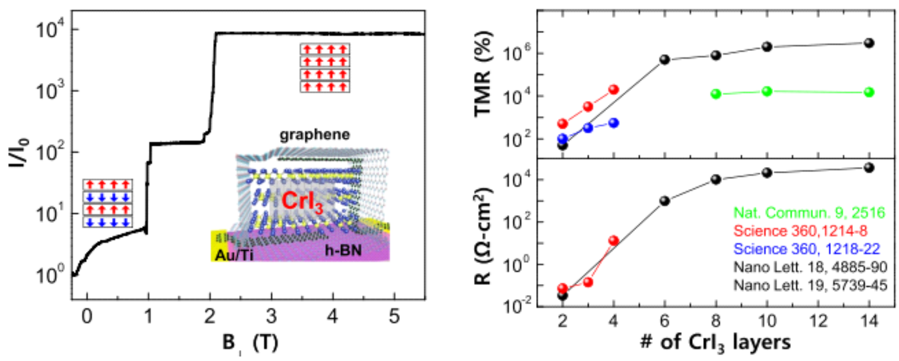
Recently, many literatures report on the excellent performance of MoS_2-based NO_2 sensing, however, lacking the study on its thermal stability. Here, the insight mechanism in NO_2 sensor reactivity of monolayer MoS_2 at different temperatures from 25 to 200 ℃ was investigated. The relative effect of the morphological properties of the sensor and gas sensor reactivity at different temperatures was observed using in situ Raman mapping, optical microscope, and scanning electron microscope to demonstrate the mechanism of temperature-dependent limit of NO_2 detection in ppb. By increasing the temperature from 25 to 100 ℃, the response of the sensor significantly improves (4.8 % vs. 54.4 %) at 200 ppb, and its limit of NO_2 detection strongly decreases (48.0 vs. 6.9 ppb). Interestingly, the sensor performance from 100 to 150 ℃ is likely equivalent to a limit of detection (LoD) that varies from 8.1 to 6.9 ppb, and the LoD slightly increases to 15.0 ppb at 200 ℃. The line damages were found in monolayer MoS_2 basal plane by heating the sample up to 200 ℃, that affect to the recovery of the NO_2 sensor. This study reveals an effective approach that may be useful in developing a gas sensor with a high response and limit of NO_2 detection in the ppb scale.

에너지변환

Nanotechnology
Volume 32, February 2021, p62003 (Impact Factor: 3.551)

Roadmap on quantum nanotechnologies

Arne Laucht, Frank Hohls, Niels Ubbelohde, M Fernando Gonzalez-Zalba, David J Reilly, Søren Stobbe, Tim Schröder, Pasquale Scarlino, Jonne V Koski, Andrew Dzurak, Chih-Hwan Yang, Jun Yoneda, Ferdinand Kuemmeth, Hendrik Bluhm, Jarryd Pla, Charles Hill, Joe Salfi, Akira Oiwa, Juha T Muhonen, Ewold Verhagen, M D LaHaye, Hyun Ho Kim, Adam W Tsen, Dimitrie Culcer, Attila Geresdi, Jan A Mol, Varun Mohan, Prashant K Jain, Jonathan Baugh



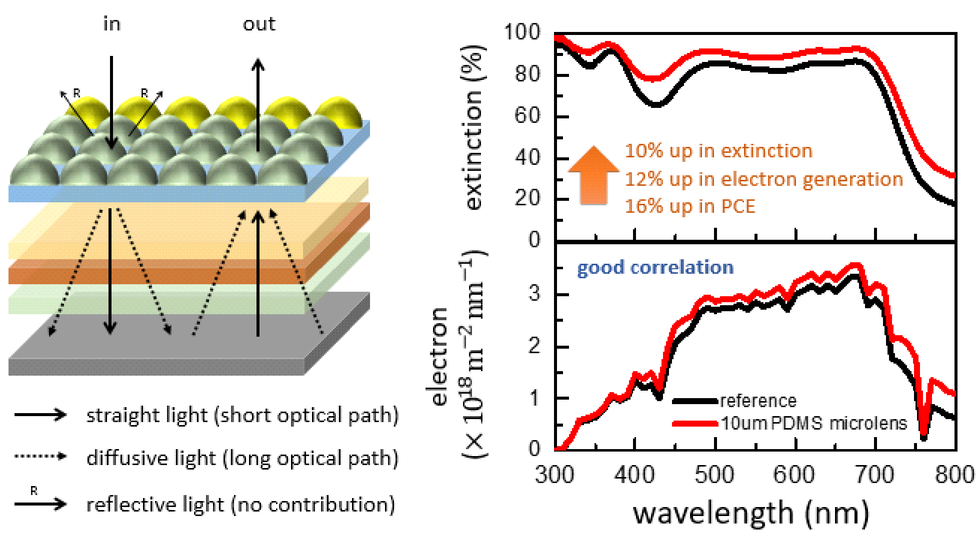
Quantum phenomena are typically observable at length and time scales smaller than those of our everyday experience, often involving individual particles or excitations. The past few decades have seen a revolution in the ability to structure matter at the nanoscale, and experiments at the single particle level have become commonplace. This has opened wide new avenues for exploring and harnessing quantum mechanical effects in condensed matter. These quantum phenomena, in turn, have the potential to revolutionize the way we communicate, compute and probe the nanoscale world. Here, we review developments in key areas of quantum research in light of the nanotechnologies that enable them, with a view to what the future holds. Materials and devices with nanoscale features are used for quantum metrology and sensing, as building blocks for quantum computing, and as sources and detectors for quantum communication. They enable explorations of quantum behaviour and unconventional states in nano- and opto-mechanical systems, low-dimensional systems, molecular devices, nano-plasmonics, quantum electrodynamics, scanning tunnelling microscopy, and more. This rapidly expanding intersection of nanotechnology and quantum science/technology is mutually beneficial to both fields, laying claim to some of the most exciting scientific leaps of the last decade, with more on the horizon.

태양에너지

RSC Advances
Volume 11, March 2021, p9766 (Impact Factor: 3.119)

Characterization of optical manipulation using microlens arrays depending on the materials and sizes in organic photovoltaics

Dongwook Ko, Bongjun Gu, Yoohan Ma, Sunjin Jo, Dong Choon Hyun, Chang Su Kim, Hyeon-Ju Oh, Prof. Jongbok Kim*



Various physical structures have improved light-harvesting and power-conversion efficiency in organic photovoltaic devices, and optical simulations have supported the improvement of device characteristics. Herein, we experimentally investigated how microlens arrays manipulate light propagation in microlens films and material stacks for organic photovoltaics to understand the influence of the constituent materials and sizes of the microlens. As materials to fabricate a microlens array, poly(dimethylsiloxane) and Norland Optical Adhesive 63 were adopted. The poly(dimethylsiloxane) microlens array exhibited higher total transmittance and higher diffuse transmittance, further enhancing the effective optical path and light extinction in material stacks for organic photovoltaics. This resulted in more current generation in an organic photovoltaic device with a poly(dimethylsiloxane) microlens array than in a Norland Optical Adhesive 63 microlens array. The sizes of the microlenses were controlled from 0.5 to 10 μm. The optical characteristics of microlens array films and material stacks with microlenses generally increased with size of the microlens, leading to a 10.6% and 16.0% improvement in the light extinction and power-conversion efficiency, respectively. In addition, electron and current generation in material stacks for organic photovoltaics were calculated from light extinction. The theoretical current generation matched well with experimental values derived from organic photovoltaic devices. Thus, the optical characterization of physical structures helps to predict how much more current can be generated in organic photovoltaic cells with a certain physical structure; it can also be used for screening the physical structures of organic photovoltaic cells.