Prof. Hui Xia

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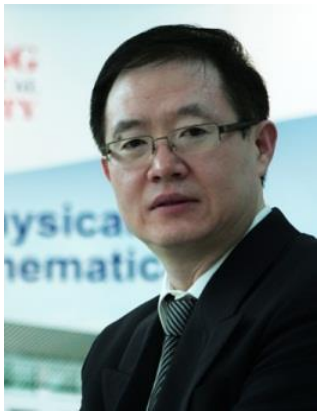
Hui Xia received his BE and ME in Materials Science and Engineering from University of Science and Technology Beijing. He obtained his PhD degree in Advanced Materials for Micro- and Nano- Systems from Singapore-MIT Alliance, National University of Singapore in 2008. He is now an Associate Professor in School of Materials Science and Engineering, Nanjing University of Science and Technology. His research interests include electrode materials for lithium-ion batteries and supercapacitors, fabrication of all-solid-state thin film microbatteries, and new battery technologies. He has published over 70 papers in international journals, such as NPG Asia Materials, Advanced Functional Materials, JACS, and ACS Nano, with more than 2000 citations. He is Editorial Board Member for Scientific Reports and Materials Technology. He is Review Editor for Frontiers in Energy Storage.

HIERARCHICAL HETEROSTRUCTURES AS PROMISING ELECTRODE MATERIALS FOR SUPERCAPACITORS

In recent years, supercapacitors have been a topic of strong and sustained interest for the development of next-generation power devices. In the past few years, the supercapacitors technology has progressed enormously owing to the development of nanostructured transition-metal oxides such as NiO, Fe_2O_3, Co_3O_4, SnO_2 and MnO_2. However, problems such as aggregation of nanoparticles and poor electronic conductivity of metal oxides impede the further improvement in electrochemical performance of supercapacitors. In our recent works, we developed hierarchical heterostructures combining the redox-active materials and highly conductive materials to boost the energy density and power density of supercapacitors. The representative works include different heterostructures of Ti@MnO_2, Co_3O_4@Pt@MnO_2, MnO_2@Ag and Fe_2O_3/graphene. The beneficial effects of the heterostructures have been demonstrated in their greatly improved supercapacitive performance.



Prof. Ze Xiang Shen

Nanyang Technological University, Singapore

Dr. Ze Xiang Shen is a Professor in the School of Physical and Mathematical Sciences, and the School of Materials Science and Engineering, Nanyang Technological University. He is the Program Chair of the Interdisciplinary Graduate School. He concurrently holds the position of Co-Director, Centre for Disruptive Photonics Technologies. His main research areas include carbon related materials, especially graphene. His work involves spectroscopic and theoretical study of few-lay graphene and folded graphene, graphene intercalation study, graphene based composites for energy harvesting (Li Ion batteries and supercapacitors) and nano electronics; He also works on developing near-field Raman spectroscopy/imaging techniques and the study of plasmonics structures where some very fundamental questions remain to be answered. He was awarded the NTU Nanyang Award for Research and Innovation 2009 as well as the Gold Medal for Research Excellence by Institute of Physics Singapore in 2011. Shen authored over 400 peer reviewed journal papers, 4 book chapters, edited 3 books and over 300 conference papers. He has a citation of >14,000 and H-index of 62.

Interlayer coupling and layer-dependent electronic structure in 2D materials

Following the extensive research work on graphene, a lot of attention has now been focused on two dimensional transition metal dichalcogenide (2D TMD) materials which can in principle compensate some of the disadvantages of graphene, such as lack of a energy bandgap. 2D TMD often show very strong layer-dependent properties. For example, their properties can be strongly influenced by the stacking of the layers, the relative orientation of the layers and the number of layers. Detailed understanding of the inter-layer interaction will help greatly in tailoring the properties of 2D TMD materials for applications. Raman/Photoluminescence (PL) spectroscopy and imaging have been extensively used in the study of nano-materials and nano-devices. They provide critical information for the characterization of the materials such as electronic structure, optical property, phonon structure, defects, doping and stacking sequence.

In this talk, we use Raman and PL techniques to study few-layer MoS_2 samples. The Raman and PL spectra show clear correlation with layer-thickness and stacking sequence. Our *ab initio* calculations reveal that difference in the electronic structures mainly arises from competition between spin-orbit coupling and interlayer coupling in different structural configurations.

Dr., Assoc. Prof. Ni Jiangfeng
Soochow University

Dr. Ni Jiangfeng earned his Ph.D. from Peking University in China in 2008. He then joined National Institute of Advanced Industrial Science and Technology (AIST) in Japan, and moved to National University of Singapore (NUS) in 2010. From February 2011, he joined the College of Physics, Optoelectronics and Energy in Soochow University as Associate Professor. Dr. Ni's research focuses on searching and developing advanced functional materials for rechargeable lithium/sodium ion battery and supercapacitor applications. He has published 7 patent applications and >50 peer-reviewed papers in material and chemistry journals with total citation of over 1100 and H-index of 18.

Nano-carbon supported materials for rechargeable Batteries

Though have shown remarkable success in portable systems, Li-ion batteries are limited by severe performance challenges of electrode materials in terms of low energy and power density as well as short durability. Owing to the unique geometric structure and extraordinary physicochemical property, nano-carbon materials could be promising support for constructing composite electrodes to overcome these problems and exhibit great potentials in battery application. Here, I will provide recent advances and general ideas for the engineering of CNT-based composites with high energy density and robust rate capability, taking molybdenum oxide and bismuth sulfide for specific examples.