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# T<sub>C</sub>SUH Special Seminar

## One Dimensional Nanomaterials for Emerging Energy Storage

Wednesday, August 2, 2017

HSC 102: 2:00PM – 3:00PM



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### ABSTRACT:

One-dimensional nanomaterials can offer large surface area, facile strain relaxation upon cycling and efficient electron transport pathway to achieve high electrochemical performance. Hence, nanowires have attracted increasing interest in energy related fields. We designed the single nanowire electrochemical device for in situ probing the direct relationship between electrical transport, structure, and electrochemical properties of the single nanowire electrode to understand intrinsic reason of capacity fading. As the battery was charged and discharged repeatedly, lithium was progressively incorporated into the electrode, causing it to lose its crystalline structure and weakening its conductivity. Then, we designed the general synthesis of complex nanotubes by gradient electrospinning, including  $\text{Li}_3\text{V}_2(\text{PO}_4)_3$ ,  $\text{Na}_{0.7}\text{Fe}_{0.7}\text{Mn}_{0.3}\text{O}_2$  and  $\text{Co}_3\text{O}_4$  mesoporous nanotubes, which exhibit ultrastable electrochemical performance when used in lithium-ion batteries, sodium-ion batteries and supercapacitors, respectively. We identified the exciting electrochemical properties (including high electric conductivity, small volume change and self-preserving effect) and superior sodium storage performance of alkaline earth metal vanadates through preparing  $\text{CaV}_4\text{O}_9$  nanowires. We also constructed a new-type carbon coated  $\text{K}_{0.7}\text{Fe}_{0.5}\text{Mn}_{0.5}\text{O}_2$  interconnected nanowires through a simply electrospinning method. The interconnected nanowires exhibit a discharge capacity of 101 mAh  $\text{g}^{-1}$  after 60 cycles, when measured as a cathode for K-ion batteries. Our work presented here can inspire new thought in constructing novel one-dimensional structures and accelerate the development of energy storage applications.

### BIOGRAPHY:

Liqiang Mai, Changjiang Scholar Chair Professor of Materials Physics and Chemistry, Distinguished Young Scholar of the National Science Fund of China, Dean for International Affairs of International School of Materials Science and Engineering at Wuhan University of Technology. He received Ph.D. degree from WUT in 2004 and carried out postdoctoral research in Prof. Zhonglin Wang's group at Georgia Institute of Technology (2006-2007). He worked as an advanced research scholar in Prof. Charles M. Lieber's group at Harvard University (2008-2011) and Prof. Peidong Yang's group at University of California, Berkeley (2017).

Prof. Mai is mainly engaged in the research field of nano energy materials and micro/nano devices. He has published over 200 papers tagged by SCI in leading journals such as *Nature*, *Nat. Nanotechnol.*, *Adv Mater.*, *J. Am. Chem. Soc.*, etc. He has conducted more than 30 research projects as project principal such as National Basic Research Program of China, National Natural Science Foundation of China, etc. He is the winner of China Youth Science and Technology Award, and Guanghua Engineering Award, Nanoscience Research Leader award, etc. He is the guest editor of *Adv. Mater.*, and serves on the Editorial and Advisory Boards of *Joule* (Cell press), *Advanced Electronic Materials*, *Nano Research* and *Science China Materials*.

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