University of Central Florida

NanoScience Technology Center
Advanced Materials Processing & Analysis Center

GRADUATE RESEARCH SEMINAR SERIES

Friday
March 24, 2017

12:15 PM

Research Pavilion
NSTC
Conference Room 169

Pizza and drinks will be provided

High-Performance Transition Metal Dichalcogenide Based Novel 1D/2D Core/Shell Nanowire Flexible Supercapacitors

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In recent years, flexible energy storage devices are undergoing an intensive research evolution to be adapted as sustainable energy model that will foster the needs of emerging flexible electronics devices such as smart wearable garments, miniature biomedical devices, flexible touch screens and e-papers. Flexible electronics demand highly integrated energy backup systems that are light weight, flexible, and safe to use. Li-ion batteries are currently the dominating energy storage source for almost all electronic gadgets, cell phones, laptops and even in light electric vehicles. The grand vision of the ubiquitous flexible electronics could not be met by Li-ion batteries as they could be easily break when twisted, folded, or bent too far, and the use of toxic, flammable Li metal pose severe limitations on their flexible energy use. In this context, flexible supercapacitors are expected to outperform/replace Li-ion batteries if their energy density could be enhanced. Construction of electrodes with novel designs facilitating a large surface area, short diffusion paths, and direct integration with current collectors is of great importance for achieving advanced supercapacitors with high energy densities. Two-dimensional (2D) transition-metal dichalcogenides (TMDs) have emerged as promising capacitive materials for supercapacitor devices owing to their intrinsically layered structure and large surface areas. Hierarchically integrating 2D TMDs with other functional nanomaterials could significantly enhance the electrochemical performances. Here, we report high-performance core/shell nanowire supercapacitors based on an array of one-dimensional (1D) nanowires seamlessly integrated with conformal 2D TMD layers. The 1D and 2D supercapacitor components possess "one-body" geometry with atomically sharp and structurally robust core/shell interfaces, as they were spontaneously converted from identical metal current collectors via sequential oxidation/sulfurization. These hybrid supercapacitors outperform previously developed any stand-alone 2D TMD-based supercapacitors; particularly, exhibiting an exceptional charge−discharge retention over 30,000 cycles owing to their structural robustness, suggesting great potential for unconventional energy storage technologies.