Non-oxide porous ceramics exhibit many unique and superior properties, such as better high-temperature stability, improved chemical inertness/corrosive resistance, as well as wide band-gap semiconducting behavior, which lead to numerous potential applications in catalysis, high temperature electronic and photonic devices, and microelectromechanical systems. Currently, most mesoporous non-oxide ceramics (e.g. SiC) are formed by two-step templating methods, which are hard to adjust pore sizes, and require a harmful etching step or a high temperature treatment to remove templates.

In this dissertation, we report a novel technique for synthesizing hierarchically mesoporous non-oxide SiC ceramic from a block copolymer precursor. The copolymer precursors with varying block length were synthesized by reversible addition fragmentation chain transfer polymerization. The block copolymer self-assembles into nano-scaled micelles with a core-shell structure in toluene. With different operation process, hollow SiC nanosphere and bulk mesoporous SiC ceramics were synthesized after the subsequent pyrolysis of precursor micelles. The resultant SiC ceramics has potential applications in catalysis, solar cells, separation, and purification processes. The polymer synthesis and pyrolysis process will investigated by NMR, FTIR, GPC, TEM, and TGA/DSC. The morphology and structure of synthesised SiC hollow sphere and mesoporous ceramics were analyzed by SEM, FIB/DSC and BET/BJH analysis.

Besides forming core shell micelles in selective solvent Toluene, we found that PVSS-b-PS could also self-assemble in the air water interface. By inducing Langmuir-Blodgett deposition, a precursor monolayer deposited on silicon wafer after the synthesized diblock copolymer self assembled in the air water interface. After pyrolysis process, SiC nano dots formed from pyrolysis of polymer precursor doped on the surface of silicon wafer, which shows great potential as an optoelectronic material. The deposition process and the relationship between compress pressure and monolayer morphology were studies, and the structure of monolayer and SiC dots were investigated by AFM, SEM.

Major: Material Science and Engineering

Educational Career:
Bachelor's of Chemical Engineering and Technology, BS, 2006, Sichuan University
Master's of Chemical Technology, MS, 2009, Sichuan University

Committee in Charge:
Linan An, Chair, Material Science & Engineering  
Shin-Tson Wu, The College of Optics & Photonics, University of Central Florida  
Jiyu Fang, Material Science & Engineering  
Lei Zhai, Nanoscience Technology Center and the Department of Chemistry

Approved for distribution by Linan An, Committee Chair, on October 10, 2014.

The public is welcome to attend.