Announcing the Final Examination of Cheng Li for the degree of Doctor of Philosophy

Time & Location: October 28, 2011 at 2:45 PM in 152 Conference room
Title: Synthesis and Properties of Self-Assembled C/SiCN Nanocomposite Derived from Polymer Precursors

The properties of C/SiCN nanocomposites synthesized by thermal decomposition of polymer precursors were studied in this work. The novel polymer-to-ceramic process enables us to tailor the ceramic structure in atomic level by designing the starting chemicals and pyrolysis procedures. It is of both fundamental and practical significance to investigate the properties and structures relationship of the nanocomposites. In this work, we explored their application potential in using as anode of lithium-ion secondary batteries.

The structure and structural evolution of C/SiCN nanocomposite were investigated by using XRD, FTIR, SEM, TEM, Solid state NMR and Raman spectroscopy. The results revealed the nanocomposites consisted of amorphous SiCnx-4 matrix and carbon nanoclusters distributed within it. The size of the carbon was measured by Raman spectroscopy, varied with starting chemicals and pyrolysis temperature.

The electronic properties of the C/SiCN nanocomposite were studied by measuring the I-V curves and a.c. impedance. The d.c. conductivity increased with carbon content and pyrolysis temperatures. The impedance spectra and fitted equivalent circuit results confirmed the existence of two phases in the nanocomposite.

The possibility of using C/SiCN as anode in lithium-ion secondary batteries was investigated by electrochemical measurements, namely cyclic voltammetry, galvanostatic cyclic test and electrochemical impedance spectroscopy. The galvanostatic measurements showed that the nanocomposite with 30% of carbon nanoclusters exhibited a specific capacity of 480 mAh/g, which is 30% higher than that of commercial graphite anode. The high capacity of the nanocomposites is attributed to the formation of a novel structure around C/SiCN interface. The excellent electrochemical properties, together with the simple, low-cost processing, make the nanocomposites very promising for Li-ion battery applications.

Major: Materials Science and Engineering

Educational Career:
Bachelor’s of B.S. in Applied Chemistry, BS, 2008, China Agricultural University

Committee in Charge:
Dr. Linan An, Chair, MMAE
Dr. Jiyu Fang, Co-Chair, MMAE
Dr. Kevin Coffey, MMAE
Dr. Chengying Xu, MMAE
Dr. Yi Liao, Chemistry
Dr. Lei Zhai, Chemistry

Approved for distribution by Dr. Linan An, Committee Chair, on October 13, 2011.

The public is welcome to attend.