

## **Bavarian's group Research projects: Summer 2014**

**Program will start: June 2, 2014 (~15 hrs per week, three days)**

**For more information please call (818)677-7746, (Prof. L. Reiner or Prof. B. Bavarian) or Visit us in JD1130 during weekday M-F**

### **Rechargeable Metal-Ion Batteries for Energy Storage**

#### RESEARCH OBJECTIVES

AIMS<sup>2</sup> students will work on Rechargeable Metal (Li, Mg, or Na)-Ion Batteries for Energy Storage focusing on materials, modeling, simulation and electrochemistry. They will be involved in literature research initially and then selection and fabrication of electrodes, materials characterization of multiple nanocompounds using x-ray photoelectron spectroscopy (XPS), AFM and FESEM/EDAX. In several of the tasks for this proposal, the anodes and cathodes will be put through a battery of electrochemical techniques using methods such as galvanostatic (double pulse), potentiostatic, potentiodynamic (CV) and EIS impedance measurements at varying temperatures. From these tests and other physical and chemical calculations, determinations of discharge voltages, discharge and charging rates, electrode capacity, cycling life and safety can be determined. Also significant to the project is a better understanding of the underlying mechanisms and reaction paths.

### **Electrochemical Testing of Biosensors**

#### RESEARCH OBJECTIVES

A basic biosensor system has a molecule bound to a polymeric layer or the active end of graphene that is embedded in a dielectric coating. For the electrochemical testing component of this project, AC voltammetry measurements will be performed using a Gamry electrochemical system equipped with PHE 220 Physical Electrochemistry Software (Cyclic Voltammetry, Linear Sweep Voltammetry, Multiple-Step Chronoamperometry, Controlled Potential Coulometry). A three-electrode configuration, consisting of a graphene nanoelectrode array, Ag/AgCl reference, and a platinum wire counter electrode will be used for the experiments. This test method applies a sinusoidal oscillating voltage (potentiodynamic) to the working electrode in an electrochemical cell; it can be combined with either a steady DC signal or voltage sweep. The current flowing at the working electrode is then plotted versus the applied voltage to give the cyclic voltammogram. CV measurement can reveal important mechanistic and kinetic information in cases where diffusion is the dominant mode of transport.

### **Corrosion Protection of Steel pipes Under Thermal Insulation**

#### RESEARCH OBJECTIVES

AIMS<sup>2</sup> students will work on use of different corrosion inhibitors to protect steel pipes in highly corrosive environments. They will be involved in literature research initially and then selection of corrosion inhibitors by using potentiostatic, potentiodynamic and EIS impedance measurements for the most effective inhibitors. From these tests a proper method corrosion inhibition will be recommended.