

## **Students' Annual Seminar**

### **Hybrid Electrodes for Energy Storage and Conversion Processes**

#### **Pallavi**

Engineering of electrodes has paramount importance in developing high energy density energy storage devices. Among the different types of batteries, Li ions based primary and secondary batteries are receiving tremendous attention. Our attempts during the last one year were to develop novel electrodes which serve as both 'thin-film' primary and secondary electrodes. Fluorinated carbon materials such as fluorographene (FG) is known for its 'primary behaviour'. Recently we have developed a method for large area FG thin film growth on various substrates without catalyst and here FG directly grown on copper electrode is used as electrode material. Our recent studies found that high temperature FG – SiO<sub>2</sub> interfacing leads to the oxygen diffusion from SiO<sub>2</sub> to FG. Such a defective silica has been attempted for its secondary electrode behaviour. Silica Nano spheres are used here to address the volume expansion of bulk silicon, which is well studied in the literature. Details of the FG-SiO<sub>2</sub> based thin film lithium ion half-cells will be discussed during the talk. On the optimization of a polymer based solid electrolyte, we studied the role of polydimethyl siloxane in polyethylene oxide based electrolyte, where we constructed a Li ion based half-cell. The PDMS is found to be augmenting the PEO based Li ion cell performance in terms of its capacity.

Further, a novel two dimensional layer of amorphous Cr<sub>2</sub>O<sub>3</sub> is identified as a co-catalyst for electrochemical hydrogen generation in alkaline and neutral media where it could protect precious metals like Pt and Au while enhancing their inherent catalytic activity. Due to the enhanced electrochemical stability of amorphous materials, amorphous Cr<sub>2</sub>O<sub>3</sub> can have potential in different electrochemical applications and those will be explored in the near future.

***Friday, Apr 5<sup>th</sup> 2019***

***2:00 PM (Tea/Coffee at 1:30 PM)***

***Seminar Hall, TIFR-H***