Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500 046

Students' Annual Seminar

On the Roles of Thermal and Light Effects in the Charging of Solar Batteries

Amar Kumar

Recent developments in the photo-rechargeable Li-ion battery signify a transformative breakthrough in the contemporary energy conversion and storage landscape. In this talk, I will be discussing our efforts on the understanding of light and thermal effects in the light based charging process in a solar battery leading to the de-intercalation of Li+ ions from cathode electrodes such as TiS_2-TiO_2 heterostructure. A detailed study based on X-ray photoelectron spectroscopy (XPS) and electron paramagnetic resonance (EPR) indicate that light irradiation induces the change in the oxidation state of Ti^{3+} to Ti^{4+}, indicating the charging process, while such a process is absent in heating. We propose that heating (45 degree-55 degree) leads to the degradation of the cathode electrolyte interface (CEI), initiating a sudden enhancement in cell voltage. In contrast, light irradiation induces no alterations in the CEI and the electrolyte while causing an intercalation and voltage enhancement. Using ^{31}P and ^{19}F NMR spectral analyses, we studied the degradation of the electrolyte (1M $LIPF_6$ in EC/EMC) during the light irradiation and resultant heating. The outcomes of these findings, along with the experimental methodologies employed, will facilitate the systematic selection and assessment of materials for the advancement of next-generation photo battery systems.

In another work, our approaches in designing a novel molecular system as a cathode for solar battery will be discussed followed by its synthesis and studies.

Tuesday, Mar 26th 2024

14:00 Hrs (Tea / Coffee 13:45 Hrs)

Seminar Hall, TIFR-H