

Ph.D. Open Seminar

Department of Chemistry, IISER BHOPAL

Speaker: Chander Pratap Singh (Thesis Advisor: Dr. Amit Paul)

Roll No: 1220203

Topic of Seminar: “Carbon-based Materials for Energy Storage Application: Improving the Science of Energy Storage.”

Date: April 3, 2017

Time: 4 pm

Venue: L-2 (LHC)

Abstract:

Owing to magnificent mechanical, electrical, thermal and optical properties of carbon-based materials, these materials have attracted immense attention for various application in the fields of electronics, optoelectronics, biomedical and energy storage.^{1a} High electrical conductivity, high surface area, tunable pore size, ease of surface modification with wide dimensionality (0-3D) of carbon based materials generated immense interest for energy storage application.^{1a} In literature, numerous synthetic methods are available for the synthesis and activation of nanostructured carbons ranging from more graphitic to less graphitic-like graphene, nanotube and charcoal.^{1b, 2} In this context, my doctoral work starts with this reasoning; Can I develop new method for synthesis of carbon based materials and further improvement of the science of energy storage?

In chapter-1, I will briefly introduce two different kind of supercapacitor (Faradaic and Non-faradaic) and challenges for solid state proton conduction.³ Chapter-2 will describe the electrochemical methods,⁴ which have been used throughout the work. In chapter-3, I will talk about graphene synthesis by using formic acid reduction and it's supercapacitor application.⁵ In chapter-4, I will describe an improved synthesis of graphene for supercapacitor application and solid state proton conduction.⁶ In chapter-5, I will discuss about a new way for the incorporation of pseudocapacitance utilizing simple physisorption.⁷ Importance and utilization of sheet edges to improve the charge storage⁸ will be discussed in chapter-6. In the final chapter, I will summarize all the findings and possible future outcomes.

References:

- (1) (a) Chang *et al. Energy Environ. Sci.* **2013**, 6, 3483. (b) Drawer *et al. Chem. Soc. Rev.* **2010**, 39, 228.
- (2) Wang *et al. J. Mater. Chem.* **2012**, 22, 23710.
- (3) Bard, A. J.; Faulkner, L. R. *Electrochemical Methods: Fundamentals and Applications*; Wiley: New York, 1980.
- (4) Achtyl *et al. Nat. Commun.* **2015**, 6, 6539.
- (5) Singh, C.; Mishra, A. K.; Paul, A. *J. Mater. Chem. A* **2015**, 3, 18557.
- (6) Singh, C.; S, N.; Jana, A.; Mishra, A. K.; Paul, A. *Chem. Commun.* **2016**, 52, 12661.
- (7) Singh, C.; Paul, A. *J. Phys. Chem. C* **2015**, 119, 11382.
- (8) Singh, C.; Paul, A. *Manuscript under preparation.*