

Ph.D. Open Seminar

Department of Chemistry

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Topic of Seminar: “Transition Metal-Based Porous Heterogeneous Electrocatalysts for Oxygen Evolution Reaction.”

Date: 06/02/2019

Time: 4 P.M

Venue: L3, LHC

Abstract:

Water-to-fuel conversion technology has drawn immense attention towards the need of global scale storage of renewable energy sources owing to rapid depletion of fossil fuel and environment pollution.^{1,2} The water to fuel conversion efficiency is limited by the high kinetic barrier of oxidation of water to oxygen (oxygen evolution reaction, OER) which is coupled with the reduction of protons to hydrogen gas as fuel.³ Therefore, the research based on electrocatalysts of earth abundant first row transition metals for water oxidation (WO)/OER has got the significant importance.² In this context, my thesis work conveys new strategies for the fabrication of highly efficient catalysts towards improvement of OER kinetics.

Chapter 1 introduces literature overview for the design of various catalysts fabrication for the enhancement of OER reaction rates. Chapter 2 discusses the experimental and characterization techniques along with the significance of several OER activity parameters. Chapter 3 discusses the synthesis of new precatalysts (cobalt phosphonates (CoOPs)) and deciphering the role of dual porosity for WO.⁴ Chapter 4 illustrates roles of porous Co₃O₄ based nanomaterials using non-ionic and cationic surfactants as template and potential dependent electrochemical impedance spectroscopy (EIS) to unravel their reactivity in physical processes towards OER.⁵ Chapter 5 explains the mass loading effect on the electrode surface to monitor the dynamic changes of intrinsic activity parameters like turn over frequency (TOF), mass activity etc.⁶ Chapter 6 elucidates the improvement of conductivity for excellent OER by synthesizing single layer Co(OH)₂ from monometallic layered hydroxide precursor.⁷ Finally, the last chapter summarizes few possible new directions towards improvement of OER.

References:

- (1) Pramanik, M.; Li, C. L.; Imura, M.; Malgras, V.; Kang, Y. M.; Yamauchi, Y. *Small* **2016**, *12*, 1709.
- (2) Risch, M.; Ringleb, F.; Kohlhoff, M.; Bogdanoff, P.; Chernev, P.; Zaharieva, I.; Dau, H. *Energy Environ. Sci.* **2015**, *8*, 661.
- (3) Enman, L. J.; Burke, M. S.; Batchellor, A. S.; Boettcher, S. W. *ACS Catal.* **2016**, *6*, 2416.
- (4) Saha, J.; Chowdhury, D. R.; Jash, P.; Paul, A. *Chem.Eur. J.* **2017**, *23*, 12519.
- (5) Jash, P.; V, Aravind.; Paul, A. Manuscript submitted
- (6) Jash, P.; V, Aravind.; Paul, A. Manuscript under preparation
- (7) Jash, P.; Srivastava, P.; Paul, A. *Chem. Commun.* **2019**, *55*, ASAP.

