Selective Synthesis of Pristine α Cobalt Hydroxide as a Precursor to Single-layer Translucent Hydroxide towards Efficient Oxygen Evolution Catalysis

Priyajit Jash, Pradhi, Azhar Khan Ansari and Amit Paul *
Department Chemistry, IISER Bhopal
Bhauri, Bhopal Bypass Road, Bhopal – 462066, Madhya Pradesh, INDIA
(E-mail: apaul@iiserb.ac.in)

Abstract: Electrochemical water splitting is a promising and appealing solution for the renewable energy conversion of water into fuel.[1] It comprises oxidizing water into oxygen and simultaneously reducing the protons into hydrogen fuels.[2] However, the water to fuel conversion efficiency is hindered by the sluggish kinetics of oxygen evolution reaction (OER) which results large overpotential causing the main bottleneck in water splitting.[3] Thus, the conventional approach to overcome the kinetic barrier is to search for highly efficient catalytic materials. Herein, we report the control fabrication of α cobalt hydroxide hydrotalcite-like compound for further transformation to translucent non-layer hydroxide by liquid phase exfoliation with a thickness of ~ 1 nm to showcase remarkable catalytic activity towards OER in the alkaline environment. The exposed active sites generated by exfoliation improved the electrolyte accessibility which provided facile electron and mass transport pathways for faster kinetics. The exfoliated single-layer cobalt hydroxide nanosheet exhibited the excellent mass activity of 110.2 Ag^{-1} which yielded high current density at lower overpotential with excellent long-term stability as compared to the layered hydroxide precursor.

References and Notes:

(1) Jiang, Y. M.; Li, X.; Wang, T. X.; Wang, C. M. *Nanoscale* **2016**, *8*, 9667.
(2) Rosen, J.; Hutchings, G. S.; Jiao, F. *J. Am. Chem. Soc.* **2013**, *135*, 4516.
(3) Koper, M. T. M. *J. Electroanal. Chem.* **2011**, *660*, 254.

Student Talk

Inter-Disciplinary Explorations in Chemistry (I-DEC 2018)

Bio-Sketch of Speaker

Mr. Priyajit Jash
PhD Student

Department: Chemistry
Institute: IISER Bhopal
Address: Bhopal Bypass Road, Bhopal-462066
Contact Number: +91-8085877244
Mail: priyajit@iiserb.ac.in

Priyajit Jash finished his B.Sc. (Chemistry Honors) from the erstwhile Presidency College, Kolkata in 2010. He completed his M.Sc. (Inorganic Chemistry specialization) from the University of Delhi in 2012. After that, he worked as a project fellow in CSIR-CMERI in the research field of high-density plastic polymer refinery waste management system towards the conversion of calorific oil for energy recycle till December 2013. In January 2014, he joined Dr. Amit Paul group at IISER Bhopal, Department of Chemistry for the Ph.D. program. Currently, he is pursuing doctoral research on electrochemical water oxidation using heterogeneous catalysts for sustainable energy storage.