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Abstract

Development of Porous-Organic-Polymer Driven Cobalt Phosphide Hybrid Nanosheet: A Smart and Durable Material for Bio-fuel Upgradation via Hydrodeoxygenation Pathway

Subhash Chandra Shit

Department of Catalysis & Fine Chemicals (C&FC), CSIR-Indian Institute of Chemical Technology (CSIR-IICT, India

Abstract:

Hydrodeoxygenation (HDO) is a promising route for the upgrading of bio-oils to eco-friendly biofuel produced from lignocellulose.1 Herein, we report the sequential synthesis of a hybrid nanocatalyst CoxP@POP, where substoichiometric CoxP nanoparticles are distributed in a porous organic polymer (POP) via solid-state phosphidation of the Co3O4@POP nanohybrid system. We also explored the catalytic activity of the above two nanohybrids toward the HDO of vanillin, a typical compound of lignin-derived bio-oil to 2-methoxy-4-methylphenol, which is a promising future biofuel. The CoxP@POP exhibited superior catalytic activity and selectivity toward desired product with improved stability compared to the Co3O4@POP. Based on advanced sample characterization results, the extraordinary selectivity of CoxP@POP is attributed to the strong interaction of the cation of the CoxP nanoparticle with the POP matrix and the consequent modifications of the electronic states. Through attenuated total reflectance-infrared spectroscopy, we have also observed different interaction strengths between vanillin and the two catalysts. The decreased catalytic activity of Co3O4@POP compared to CoxP@POP catalyst could be attributed to the stronger adsorption of vanillin over the Co3O4@POP catalyst. Also from kinetic investigation, it is clearly demonstrated that the Co3O4@POP has higher activation energy barrier than the CoxP@POP, which also reflects to the reduction of the overall efficiency of the Co3O4@POP catalyst. To the best of our knowledge, this is the first approach in POP-encapsulated cobalt phosphide catalyst synthesis and comprehensive study in establishing the structure-activity relationship in significant step-forwarding in promoting biomass refining.

Biography:

He is a professor at Department of Catalysis & Fine Chemicals (C&FC), CSIR-Indian Institute of Chemical Technology.

Publication of speakers:

- Palladium Nanoparticles Encaged in a Nitrogen‐Rich Porous Organic Polymer: Constructing a Promising Robust Nanoarchitecture for Catalytic Biofuel Upgrading, R Singuru, K Dhanalaxmi, SC Shit, BM Reddy, J Mondal
- Cu–Pd bimetallic nanoalloy anchored on a N-rich porous organic polymer for high-performance hydrode-oxygenation of biomass-derived vanillin, SC Shit, R Singuru, S Pollastri, B Joseph, BS Rao, N Lingaiah, J Mondal
- Ruthenium nanoparticle-decorated porous organic network for direct hydrodeoxygenation of long-chain fatty acids to alkanes, S Mondal, R Singuru, S Chandra Shit, T Hayashi, S Irle, Y Hijikata

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