



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

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Abstract:

Hydrodeoxygenation (HDO) is a promising route for the up-gradation of bio-oils to eco-friendly biofuel produced from ligno-cellulose.¹ Herein, we report the sequential syn-thesis 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 vanil-lin, 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 ac-tivity and selectivity toward desired product with improved stability compared to the Co₃O₄@POP. Based on advanced sample characterization results, the extraordinary se-lectivity 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 ob-served different interaction strengths be-tween 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 van-illin over the Co₃O₄@POP cat-alyist. Also from kinetic investigation, it is clearly demonstrat-ed that the Co₃O₄@POP has higher activation energy barrier than the CoxP@POP, which also reflects to the re-duction of the overall efficiency of the Co₃O₄@POP catalyst. To the best of our knowledge, this is the first approach in POP-encapsu-lated cobalt phosphide catalyst synthesis and comprehensive study in establishing the structure-activity relationship in signif-icant step-forwarding in promoting biomass refining.



Biography:

I have done Master of Science (MSc) in Chemistry from Indi-an Institute of Technol-ogy, Kharagpur, (IIT-KGP) the one of the prestigious and premiere academic organiza-tion in India. Currently, I am pursuing PhD from CSIR-Indian Institute of Chemical Technology (CSIR-IICT) under the supervi-sion of Dr. John Mondal, Scientst at Cataly-sis & Fine Chemicals (C&FC) division. I have been working on “Development of Ro-bust Porous Nanoarchitecture as Het-erogeneous Catalyst for Energy and En-vironmental application.” I have already pub-lished in 7 publications (89 citations with h-index 6) in Interna-tional Journals of well repute

Publication of speakers:

1. Shit, S. C.; Singuru, R.; Pollastri, S.; Jo-seph, B.; Rao, B. S.; Lingaiah, N.; Mondal, J. Catal. Sci. Technol. 2018, 8, 2195-2210.
2. Shit, S. C.; Koley, P.; Joseph, B.; Marini, C.; Nakka, L.; Tardio, J.; Mondal, J. ACS Appl. Mater. Interfaces 2019, 11, 24140-24153.

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