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Zeolites as catalysts for the transformation of biorenewable substrates to valued chemicals and fuels

K K Pant, Ejaz Ahmad and Dinesh Gupta
Indian Institute of Technology, India

Depletion of fossil fuel and the awareness of climate change demand the utilization of bio-renewable resources on a large scale for the production of chemicals and fuels. In this context, lignocellulosic biomass and carbohydrates derived furan based chemical, 5-hydroxymethylfurfural (HMF), furfural and levulinic acid (LA) and its derivative have received a significant attention as a platform chemical for producing a broad range of valued chemicals, biofuels and polyester building block chemicals. Currently, high production cost of biomass derived chemicals and fuels are a major challenge for its large scale application as a starting substrate. To overcome these challenges, we have synthesized and characterized dual Lewis-Brønsted acidic metal doped Zeolite as heterogeneous materials for biomass conversion. These recyclable Zeolite as solid acidic materials have been tested to be effective for the production of ethyl levulinate, LA, furfural and HMF in aqueous and biphasic solvent systems. The presentation will emphasize our sustainable catalytic approaches for the one-pot conversion of carbohydrate and furanics intermediate and its derivative has been achieved by using as-synthesized and modified Zeolite as solid acid catalyst containing strong Brønsted and Lewis acidic sites. The presence of high acid density and attachment of metal on Zeolite sheet is confirmed by ICP, HRTEM, NH₃-TPD, XPS, FESEM, FT-IR, and XRD. Reaction route and product intermediate are monitored by kinetics modeling and analytical analysis to understand the catalyst and substrate interaction and we can optimize the synthesis method for maximum yield and selectivity of product.

kkpant@chemical.iitd.ac.in