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Metal nanoparticles for green and sustainable catalytic applications

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Nanostructure materials are emerging as the most intensive research area for their diverse applications. The nanoparticles based catalyst precursors for organic synthesis is a challenge for researchers. The nano-catalysts contain highly reactive surfaces and their catalyzed reactions are likely to provide the advantages of high atom efficiency, simplified isolation of products and easy recovery and recyclability of the catalysts. Different stabilizers/supports like organic ligands, polymer, zeolites, clay etc. are used to control the morphology and sizes of nanoparticles for specific applications. Modified montmorillonite exhibiting high surface area, micro- and mesopores were advantageously utilized for stabilizing different metal nanoparticles. Metal nanoparticles were generated *in situ* by incipient wetness impregnation of suitable metal salts into the nanopores of the clay followed by reduction with suitable reducing agents like polyol, NaBH₄ etc. and are characterized by Powder XRD, SEM-EDX, HRTEM, XPS, N₂-adsorption analysis etc. The metal nanoparticles, exhibiting size below 10 nm, are found as efficient heterogeneous Green catalysts. Herein, we highlight some of our recent metal nanoparticles catalysed important organic synthesis: (a) Cu⁰-montmorillonite catalyzed multi-component coupling reactions via *sp* C-H activation for the synthesis of bio-active molecules; (b) Rh⁰-nanoparticles-montmorillonite for transfer hydrogenation of carbonyl compounds to corresponding alcohols; (c) Chemoselective hydrogenation of chloronitrophenol catalyzed by Pt⁰-nanoparticles; (d) Pd⁰-nanoparticles-montmorillonite serve as efficient heterogeneous catalyst for the Suzuki, Heck and Sonogashira coupling reactions. In all the reactions, high conversion with nearly 100% selectivity is observed. The nanocatalysts could be recycled and reused several times without significant loss of their catalytic activity.

Biography

Dipak Kumar Dutta has completed his PhD at the age of 27 years from Dibrugarh University, India. He is a Chief Scientist of CSIR-NEIST, Jorhat, Assam, India. He has published 80 papers in reputed journals and filed/granted 44 Patents and is an author of 5 book chapters. He guided 15 PhD students and is an editorial board member of a journal.

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