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Mesoporous materials: Synthetic methodologies

Pranjal Kalita
India Habitat Centre, India

Mesoporous silica nanoparticles have received much more attention in recent years due to their unique structures with organized porosity, high surface area, and specific pore volume, which have several potential applications in the field of adsorption, separation, sensors, and fuel cells. Moreover, substitutions of metals in the silica framework have yielded fruitful results in the field of catalysis. Over the different kind of mesoporous materials, we had investigated several organic reactions such as aza-Michael, Pechmann reaction for synthesis of coumarin, β-hydroxy esters/α, β-carbonyl compounds and 1, 5-dicarbonyl compounds via Mukaiyama-aldol and Michael reactions, Friedel-Craft alkylation, β-amino alcohol via ring opening of epoxides with indole/pyrole/aromatic amines, etc. The products are mainly used as starting/intermediate compounds for preparation of an insecticide such as hymecromone, anticoagulants, as additives in food and cosmetics, etc. The detail synthesis and thorough characterization of the mesoporous materials shall be focused in the presentation. The synthesized catalysts have the potential activities as mentioned above reactions. The all catalysts could be reused for several recycles. The catalytic activities were found to be decreased gradually as increasing the recycles. This is mainly because of the leashing of the metal or active compound from the materials. The detailed results on the effect of the different weight percentage, reaction temperature, active sites and textural parameters will be discussed during the presentation.

Biography

Pranjal Kalita is currently working as an Associate Fellow in The Energy and Resources Institute (TERI), New Delhi, India. His broad research areas are heterogeneous catalysts, pyrolysis, alternative fuel, chemical intermediate through different types organic reactions. He is the reviewer for several peer reputed international journals and supervising graduate and undergraduate students in TERI, India and USA. He has published his research paper as corresponding author and gathered 19 nos. scientific publications in international journals. Presently, he is working on pyrolysis of biomass and upgradation bio-oil to alternative fuel over multifunctional heterogeneous catalysts. He received his PhD degree from National Chemical Laboratory (NCL), Pune, India on 2008 February and topic entitled "Carbon-Carbon Bond Formation Reactions Using Solid Porous Catalysts". He has been awarded CSIR-JRF in the year of 2002 June in the subject of Chemical Sciences. He has worked as Junior Research Fellow under CSIR-project in the area of Organic Chemistry in Gauhati University, Department of Chemistry, Assam, after finishing his Master degree in Chemistry and Physical Chemistry as a special paper from Assam University, Central, Silchar, Assam.

Pranjal.Kalita@teri.res.in

Surface functionalization of electrospun carbon nanofibers and their applications as biosensors

Qufu Wei and Dawei Li
Jiangnan University, China

Carbon nanofibers (CNFs) and nickel nanoparticle loaded carbon nanofibers (NiCNFs) were prepared by a combined method of electrospinning and high temperature carbonization. Afterwards, three types of surface functionalization, bio-functionalization, hydrothermal reduction and electrostatic adsorption, were performed to enhance the eletrocatalysis of the CNFs and NiCNFs. A composite of polydopamine (PDA)-laccase (Lac)-NiCNFs was obtained through one-pot Lac-catalyzed oxidation of dopamine (DA) in an aqueous suspension containing Lac, NiCNFs and DA. Zinc oxide (ZnO) loaded carbon nanofibers (ZnO/CNFs) were successfully fabricated by a hydrothermal process in a mixture solution containing the CNFs and zinc acetate dihydrate. Graphene-loaded carbon nanofibers (G/CNFs) were successfully synthesized by a combined method of electrostatic adsorption and green reduction. Finally, these functionalized carbon nanofibers combined with biological molecules were successfully applied in designing biosensors and the biosensors showed high-efficient electrocatalysis toward corresponding substances with high sensitivity and low detection limit. Thus, these functionalized carbon nanofibers may find their potential applications in biosensors, catalyst, fuel cell and other areas.

qfwei@jiangnan.edu.cn