REPORT OF THE PROJECT PROPOSAL SANCTIONED UNDER RUSA 2.0

TITLE: Development of metal nanoparticles supported heterogeneous catalysts for organic transformations

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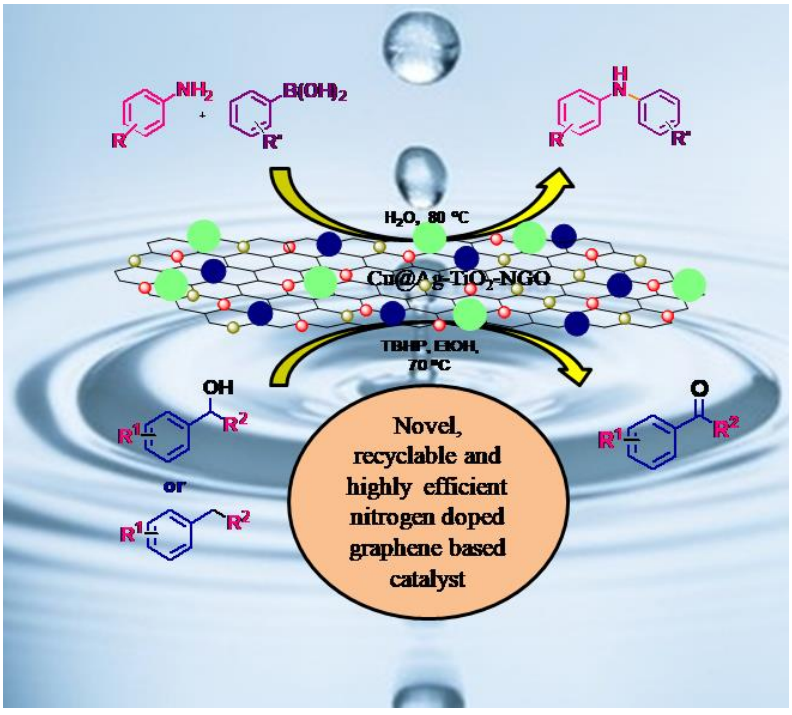
DEPARTMENT: Chemistry

The seed money received under RUSA 2.0 has been utilized for research work proposed in the project proposal. The salient features of the work done are discussed below:

1. Ag-Cu bimetallic NPs were successfully decorated on modified GO and its activity was evaluated for the oxidation and C–N coupling reactions. Ten different catalysts based on immobilization of bimetallic Ag-Cu and monometallic Ag and Cu on modifed GO were synthesized in order to study the synergism between two metals as well as effect of N-doping prior to and after modification of GO with TiO_2. Comparison of the catalytic activity revealed Cu@Ag-TiO_2-NGO to exhibit significantly higher catalytic activity for the oxidation of alcohols and hydrocarbons as well as Chan-Lam coupling reactions compared to other prepared catalysts. This enhanced performance of the synthesized catalyst was attributed to the presence of nitrogen functionalities in the GO and the electronic synergism between Ag and Cu metal nanoparticles as depicted by XPS.

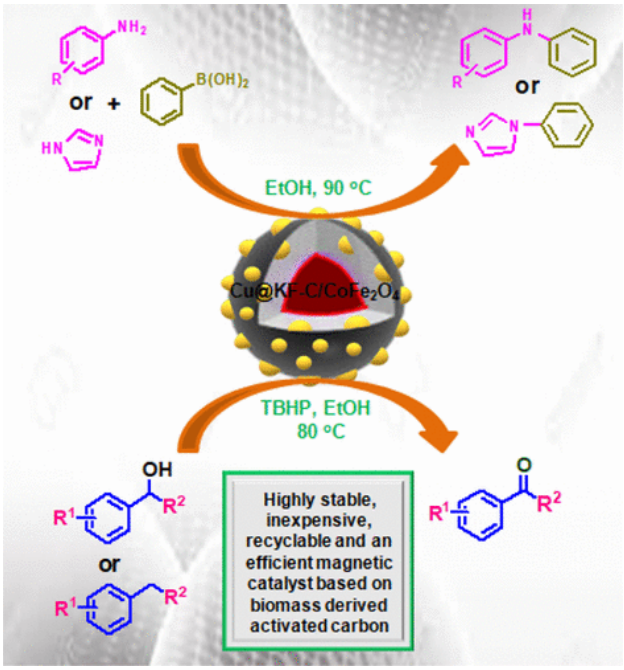


RSC Adv., **2020**, *10*, 30048-30061.

2. Mn^{3+}- and Mn^{2+}-doped Pd@L-dopa functionalised ZnO coated Fe_3O_4 nanoparticles were synthesized and their catalytic activities were compared with the corresponding undoped counterpart for C-C coupling, reduction and oxidation. Doped catalysts were found to be more active and selective than the undoped counterpart for the respective organic transformations and excellent yields of the corresponding products were obtained. Efforts were made to provide mechanistic insights into the promotional role of dopant by means of various characterization techniques.

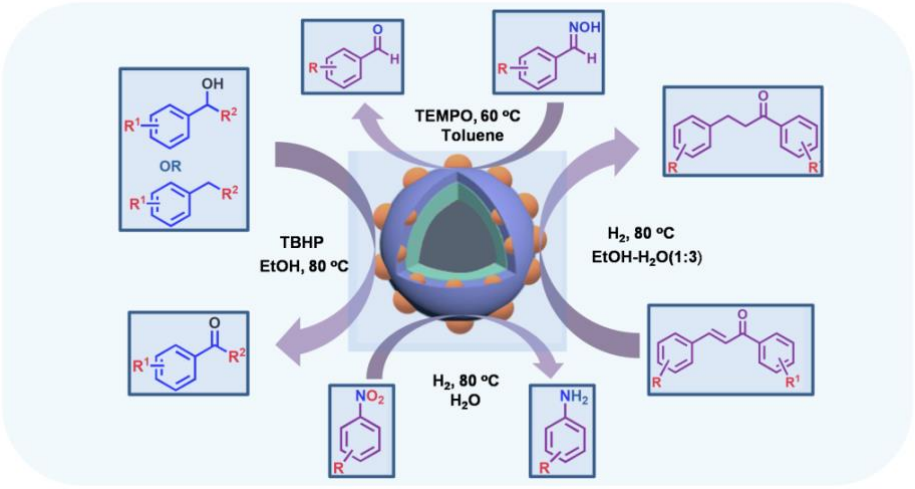
ACS Appl. Nano Mater., **2020**, *3*, 10310-10325.

3. Biomass derived activated carbon supported magnetic Cu catalysts were prepared (Cu@ KF-C/MFe_2O_4, M = Co, Cu, Ni, and Zn) and their catalytic activities were tested for Chan-Lam cross coupling and oxidation of alcohols, wherein Cu@KF-C/$CoFe_2O_4$ showed the highest activity among the synthesized catalysts. The enhanced catalytic behaviour of Cu@KF-C/$CoFe_2O_4$ was attributed to the porous structure and high amount of Cu(0) (as indicated by BET and XPS respectively) in comparison to other catalysts.



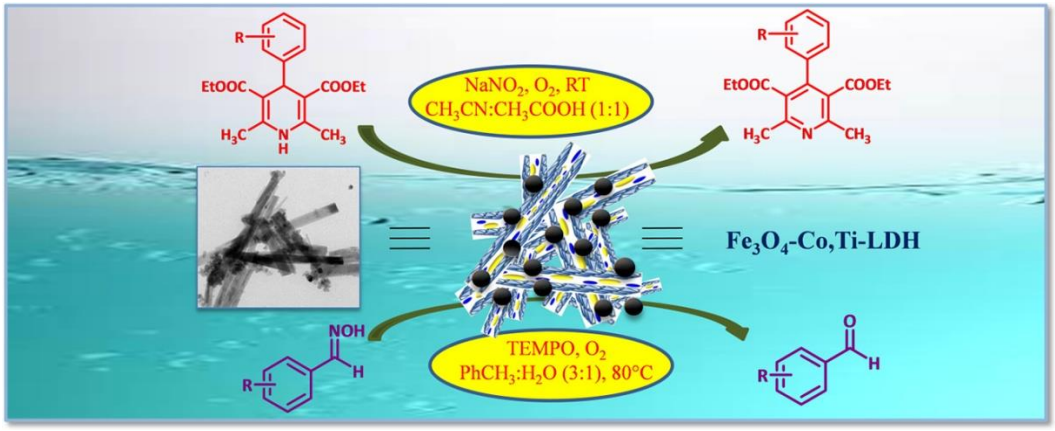
ACS Omega, **2021**, *6*, 19529-19545.

4. Magnetic zeolitic imidazolate framework supported palladium catalyst (Pd@ZIF-67-Fe_3O_4-TiO_2) has been synthesized which possess high surface area (205 m^2g^{-1}), large pore volume (0.10 cm^3g^{-1}), good magnetic responsivity (10.71 emu g^1) and high stability. A comparative analysis of Pd@ZIF-67-Fe_3O_4-TiO_2 and Pd@Fe_3O_4-TiO_2 catalysts for oxidation, reduction and oxidative deprotection of oximes was done to investigate the effect of ZIF-67 on the catalytic performance of Pd species. A substantial difference in the activity and stability was observed in the presence of ZIF-67 suggesting that the ZIF-67 play an important role in enhancing the activity of Pd(II). This superior catalytic activity and stability arises due to the synergistic effect between well-dispersed palladium species and highly porous ZIF-67.



New J. Chem., **2021**, *45*, 20309-20322.

5. Co and Ti-based magnetic LDH (Fe_3O_4-Co,Ti,Mg,Al-LDH, Fe_3O_4-Co,Ti,Mg-LDH, Fe_3O_4-Co,Ti,Al-LDH and Fe_3O_4-Co,Ti-LDH) were synthesized with partial and complete substitution of Mg^{II} and Al^{III} atoms in the basic Mg,Al-LDH structure. The catalytic activity of these catalysts was compared for the oxidative aromatization of 1,4-DHP and oxidative deprotection of oximes, wherein the best results were obtained with Fe_3O_4-Co,Ti-LDH. The synthesized catalysts were analyzed by employing different characterization techniques like BET, FT-IR, TGA, XRD, and XPS. Based on the results, the enhanced catalytic performance of Fe_3O_4-Co,Ti-LDH was combinedly attributed to the successful fabrication, high thermal stability and specific surface area, and more surface-active Co species.



Appl. Clay Science, **2021**, *214*, 106288.

Signature with name: Prof. Satya Paul

Date: June 10, 2022