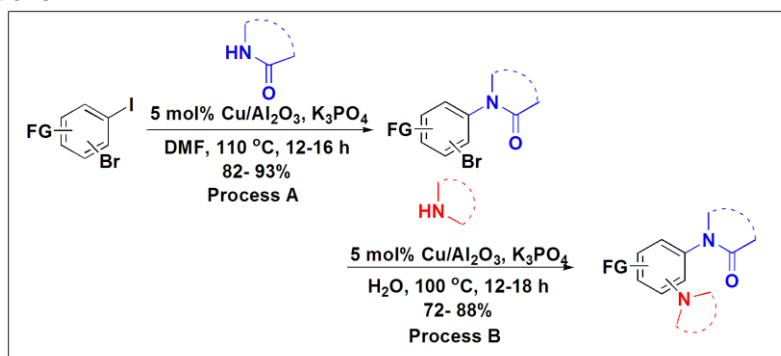


Research Summary

Heterogeneous Cu(II)-Catalysed Solvent-Controlled Selective N-Arylation of Cyclic Amides and Amines with Bromo-iodoarenes.

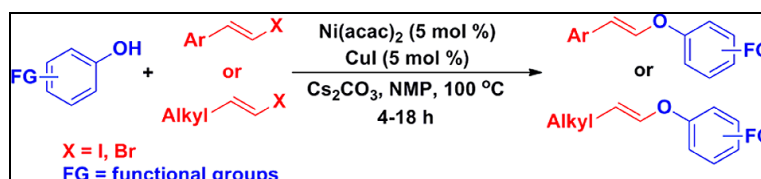
A solvent controlled *N*-arylation of cyclic amides and amines in DMF and water, respectively, catalysed by Cu(II)/Al₂O₃ has been achieved. This protocol has been employed for the synthesis of a library of arenes bearing a cyclic amide and an amine moiety at two ends, including a few scaffolds of therapeutic importance. The mechanism has been established based on detailed electron paramagnetic resonance (EPR) spectroscopy, X-ray photoelectron spectroscopy (XPS), UV diffuse reflectance spectroscopy (DRS) and inductively coupled plasma-mass spectrometry (ICP-MS) studies of the catalyst at different stages of the reaction. Interestingly it was found that the amide-coupling in DMF proceeds through a tetrahedral intermediate where the amine-coupling in water proceeds through a square-planar intermediate. The Cu(II)/Al₂O₃ catalyst was recovered and recycled for subsequent reactions.



D. Kundu, S. Bhadra, N. Mukherjee, B. Sreedhar and B. C. Ranu, *Chem. -Eur. J.* **2013**, 19, 15759

Copper-assisted nickel catalyzed ligand-free C(sp²)-O cross-coupling of vinyl halides and phenols

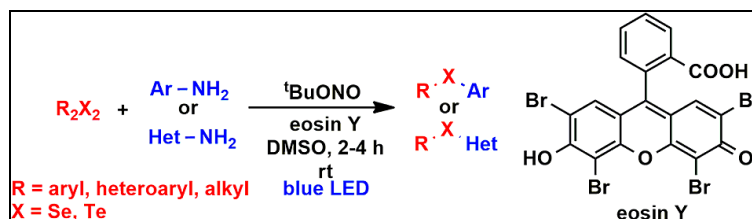
Ni-catalysts have received much attention due to their relatively low cost and interesting catalytic features. Several Ni catalysts have been successfully used for the synthesis of important organic molecules. This prompted us to explore the hitherto unreported application of a Ni-catalyst for the vinylation of phenols without using any ligand. In a preliminary experiment we found that Ni-salt alone cannot initiate the reaction of vinyl bromide and phenol. However, the presence of a Cu-salt in the system triggered the reaction. Thus, as a part of our continuing program on transition metal catalyzed reactions we report here a Cu-assisted Ni-catalyzed ligand free cross-coupling of aromatic alcohols with styrenyl and vinyl halides (I and Br).



D. Kundu, P. Maity and B. C. Ranu, *Org. Lett.* **2014**, 6,1040

Visible light photocatalyzed direct conversion of aryl-/heteroarylamines to selenides at room temperature

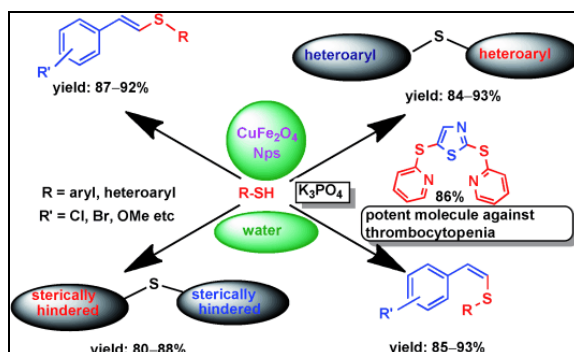
A novel strategy for the direct conversion of aryl and heteroarylamines to selenides has been developed via diazotization of amines with tert-butyl nitrite in neutral medium followed by reaction with diaryl/diheteroaryl/dialkyl diselenides in one pot under photocatalysis at room temperature in the absence of any metal. This reaction is also applied for the synthesis of tellurides. The selenylation of heteroarylamines by this protocol is of much significance because of the difficulty in diazotization of these molecules by a standard diazotization method in acid medium.



D. Kundu, S. Ahammed and B. C. Ranu, *Org. Lett.* **2014**, *6*, 1814

Magnetically Separable $CuFe_2O_4$ Nanoparticles Catalyzed Ligand-Free C-S Coupling in Water: Access to (*E*)- and (*Z*)-Styrenyl-, Heteroaryl and Sterically Hindered Aryl Sulfides

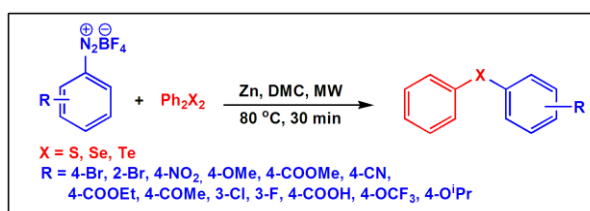
An efficient coupling of styrenyl, heteroaryl and sterically hindered aryl halides with aryl- and heteroarylthiols catalyzed by the bimetallic Cu and Fe nanomaterial, $CuFe_2O_4$, in water in the presence of tetrabutylammonium bromide and potassium phosphate (K_3PO_4) has been achieved without using any ligand. A series of unsymmetrical functionalized (*E*)- and (*Z*)-styrenyl aryl, heteroaryl heteroaryl and sterically hindered aryl aryl sulfides has been obtained by this procedure. The compounds are obtained in high yields and excellent stereoselectivity has been observed for styrenyl sulfides. The catalyst can be easily separated by an external magnet and recycled for ten times without any appreciable loss of activity. This procedure provides an easy access to useful and challenging biologically active organosulfides which are difficult to achieve by other methods.



D. Kundu, T. Chatterjee and B. C. Ranu, *Adv. Synth. Catal.* **2013**, *355*, 2285

Microwave-assisted reaction of aryl diazonium fluoroborate and diaryl dichalcogenides in dimethyl carbonate: a general procedure for the synthesis of unsymmetrical diaryl chalcogenides

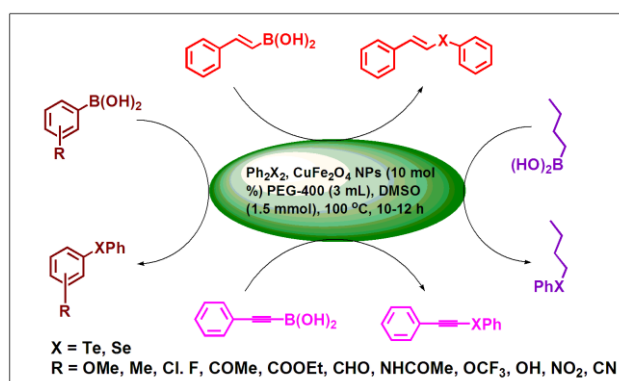
A convenient, general and efficient procedure for the synthesis of unsymmetrical diaryl chalcogenides has been developed by the reaction of aryl diazonium fluoroborates and diaryl dichalcogenides in the presence of zinc dust in dimethyl carbonate under microwave irradiation. The reactions of a wide range of substituted aryl diazonium fluoroborates and diaryl dichalcogenides have been addressed. The zinc dust is required for the cleavage of diaryl dichalcogenides.



D. Kundu, S. Ahammed and B. C. Ranu, *Green Chem.* **2012**, *14*, 2014

A general and green procedure for the synthesis of organochalcogenides by CuFe₂O₄ nanoparticle catalysed coupling of organoboronic acids and dichalcogenides in PEG-400

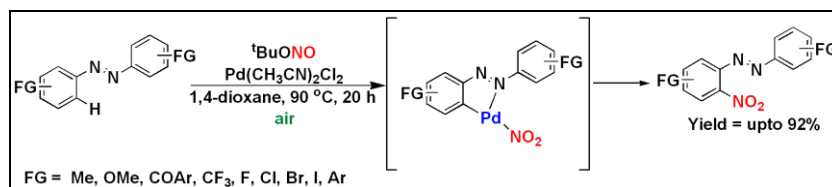
A general and efficient procedure has been developed for the synthesis of organochalcogenides (selenides and tellurides) by a simple reaction of organoboronic acids and dichalcogenides catalysed by CuFe₂O₄ nanoparticles in PEG-400 without any ligand. This protocol offers the scope for access to a wide spectrum of chalcogenides including diaryl, aryl–heteroaryl, aryl–styrenyl, aryl–alkenyl, aryl–allyl, aryl–alkyl and aryl–alkynyl versions. The catalyst is magnetically separable and recyclable eight times without any loss of appreciable catalytic activity.



D. Kundu, N. Mukherjee and B. C. Ranu, *RSC Adv.* **2013**, *3*, 117

Tert-butyl nitrite mediated regioselective nitration of (*E*)-azoarenes via palladium catalyzed directed C-H activation

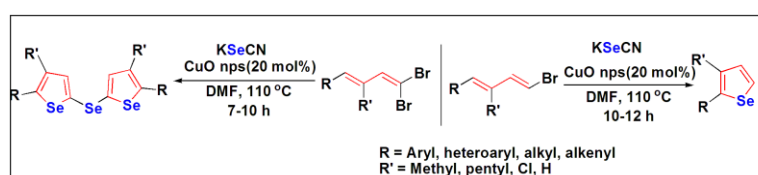
An efficient protocol for the Pd-catalyzed regioselective *ortho*-nitration of (*E*)-azoarenes has been achieved for the first time using *t*BuONO as a nitrating agent under atmospheric oxygen. A series of both symmetrical and unsymmetrical azoarenes were nitrated efficiently by this procedure providing excellent chemo- and regio-selectivity and compatibility with a broad array of functional groups.



B. Majhi, D. Kundu, S. Ahammed and B. C. Ranu *Chem. -Eur. J.* (accepted)

Direct Synthesis of selenophenes by Cu-catalyzed one-pot Addition of Selenium Moiety to (*E*)-1,3-Dienyl Bromides and Subsequent Nucleophilic Cyclization

An efficient protocol for the synthesis of selenophenes and selenyl selenophenes has been achieved by a simple one-pot reaction of 1,3-dienyl bromides and 1,3-dienyl-gem-dibromides respectively with KSeCN catalyzed by CuO nanoparticles. Several aryl, alkenyl, heteroaryl and alkyl substituted selenophenes were obtained with a broad array of functional group tolerance. This is found to be a general methodology for chalcogenophenes being effective for the synthesis of thiophenes too.



P. Maity, D. Kundu, R. Roy and B. C. Ranu (*communicated*)

