Pd@GO/Fe3O4/PAA/DCA: a novel magnetic heterogeneous catalyst for promoting the Sonogashira cross-coupling reaction

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Abstract

A hybrid system involving graphene oxide (GO), magnetic oxide (Fe3O4), acrylamide and dicyandiamide was prepared via amine functionalization of GO/Fe3O4 by means of covalent bonding with acrylamide and subsequent reaction with dicyandiamide to provide a multinitrogen containing polymer on the surface of GO. This hybrid system was utilized as a heterogeneous catalyst support for immobilizing Pd nanoparticles to provide the hybrid, Pd@GO/Fe3O4/PAA/DCA. This nano-Pd composite was characterized using Fourier transform infrared, transmission electron microscopy, scanning electron microscopy, vibrating sample magnetometer, thermogravimetric analysis, X-ray diffraction, and ICP techniques and used for promoting Sonogashira cross-coupling under mild reaction conditions. This heterogeneous and magnetic catalyst was easily separated by external magnet and was reused in a model reaction, efficiently up to six times with slight loss of catalytic activity and Pd leaching, showing the suitability of GO/Fe3O4/PAA/DCA for embedding Pd nanoparticles. To check the effect of the number of surface nitrogens of the polymeric chain on the catalytic performance, the activity of the catalyst was compared with Pd@GO/Fe3O4/PAA; increased number of the surface nitrogens on the chain polymer leads to higher loading of Pd and lower the Pd leaching.

Keywords: GO, Fe3O4, acrylamide, dicyandiamide, Pd nanoparticles, copper and ligand-free, Sonogashira cross-coupling reaction