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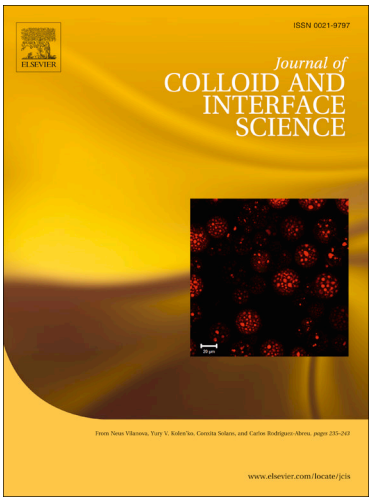

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Carbon-nanotube-based Rhodium Nanoparticles as Highly-active Catalyst for Hydrolytic Dehydrogenation of Dimethylamineborane at Room Temperature

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Abstract

In this study, we present a carbon nanotube-based Rh nanomaterial as a highly active catalyst for the hydrolytic dehydrogenation of dimethylamine – borane (DMAB) at room temperature. The prepared multi-walled carbon nanotube based Rh nanoparticles, called Rh NPs@ MWCNT, was readily prepared, stabilized and effectively used for the hydrolytic dehydrogenation of DMAB under ambient conditions. Monodisperse Rh NPs@ MWCNT nanocatalyst was characterized by using advanced analytical methods such as X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), transmission electron microscopy (TEM), high-resolution transmission electron microscopy (HR-TEM) *etc.* These analytical methods revealed that Rh nanoparticles on the surface of MWCNT were well dispersed and the average particle size was found to be 1.44 ± 0.17 nm. The catalytic experiments revealed that the new Rh NPs@MWCNT nanocatalyst has a high catalytic effect to obtain hydrogen in 3.0 equation from DMAB, and the record catalytic TOF value for the catalytic reaction catalyzed by Rh NPs@MWCNT nanocatalyst was found to be 3010.47 h^{-1} at room temperature. The current study presents the detailed kinetic studies of the hydrolytic dehydrogenation of DMAB catalyzed by Rh NPs@MWCNT, the results of catalytic experiments were performed at different temperatures, substrate and catalyst concentrations, the Rh NPs@MWCNT nanocatalyst was effectively used in the completion of the hydrolytic dehydrogenation of DMAB, and activation energy, enthalpy and entropy parameters. The experimental results showed that monodisperse Rh NPs@MWCNT nanocatalyst have record

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