EXPLORING THE CATALYTIC ACTIVITY OF METAL NANOPARTICLES IN FUNCTIONALIZED MESOPOROUS SILICA

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ABSTRACT

The catalytic activity of highly dispersed metal nanoparticles in functionalized mesoporous silica SBA-15 prepared by a solution technique is demonstrated. The surface of SBA-15 was functionalized with positively charged groups, and anionic metal species were subsequently incorporated into the channel system via ion exchange. The anionic metal precursors were then reduced by either H₂ flow or by NaBH₄ solution. Among the as-synthesized Au catalysts, two of them show activity for CO oxidation at room temperature. The most active Au catalyst was found to catalyse the reaction with a rate of 2.7x10⁻⁴ mmol g⁻¹ cat⁻¹ s⁻¹, which is more active than any other silica-supported system made by a solution technique. On the other hand, supported Pd and Pd-Au nanoparticles in SBA-15 show capabilities as catalysts for Heck reactions. Buchwald-Hartwig-aminations and Suzuki-reactions are catalysed as well, but the yields, turn-over-numbers (TONs) and turn-over-frequencies (TOFs) in these transformations are substantially lower than those of standard solution phase systems.

Keywords: metal nanoparticles, mesoporous silica, functionalization, CO oxidation, Heck reaction