EXPLORING THE CATALYTIC ACTIVITY OF METAL NANOPARTICLES IN FUNCTIONALIZED MESOPOROUS SILICA

Yang, C., Wüstefeld, H., Kalwei, M. and Schüth, F.

MPI für Kohlenforschung, Kaiser-Wilhelm-Platz 1, 45470 Mülheim an der Ruhr, Germany.
E-mail: schueth@mpi-muelheim.mpg.de

ABSTRACT

The catalytic activitiy 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 H_2 flow or by $NaBH_4$ 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 2.7×10^{-4} mmol g_{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