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Gold nanoparticles in SBA-15 showing catalytic activity in CO oxidation

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Abstract

The preparation of an active gold catalyst for CO oxidation, supported on silica, made by a novel solution technique is reported. The surface of SBA-15 was functionalized with positively charged groups, and $[AuCl_4]^-$-species were subsequently incorporated into the channel system via ion exchange. Upon reduction with $NaBH_4$, highly dispersed nanoparticles of gold were formed in the channels of the mesoporous host. A reaction rate of 2.7×10^{-4} mmol g_{cat}^{-1} s^{-1} in CO oxidation was found for this composite material. Compared with a previously reported material obtained by a chemical vapor deposition (CVD) method, this reaction rate is still lower by about one order of magnitude. However, the straightforward preparation method reported here still yields more active catalysts than any other Au/SiO_2 system made by a solution technique, which show almost no activity at room temperature. Since the gold particles are essentially isolated from the support by the organic coating of the channels, a support–metal interaction is highly improbable as the source of the catalytic activity of the gold. TEM images of Au/SBA-15 reveal that gold particles start sintering at temperatures higher than 100 °C. Due to this effect, a significant drop in catalytic activity is observed.

Keywords: Gold catalysts; CO oxidation; Mesoporous silica; Functionalization