

Au@MOF-5 and Au/MO_x@MOF-5 (M = Zn, Ti; x = 1, 2): Preparation and Microstructural Characterisation

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The Zn-carboxylate-based porous coordination polymer MOF-5 [Zn₄O(bdc)₃] and the metal oxide loaded materials ZnO@MOF-5 and TiO₂@MOF-5 were loaded in a second step with the precursor [ClAuCO] to yield intermediate materials denoted as [ClAuCO]@MOF-5, [ClAuCO]/ZnO@MOF-5 and [ClAuCO]/TiO₂@MOF-5. These composites were decomposed to Au@MOF-5, Au/ZnO@MOF-5 and Au/TiO₂@MOF-5 under hydrogen at 100 °C. The nanoparticle-loaded hybrid materials were characterised by powder X-ray diffraction (PXRD), IR spectroscopy, X-ray photoelectron spectroscopy (XPS) and N₂ sorption measurements, which reveal an intact MOF-5 structure that maintains a high specific surface area. For Au@MOF-5, crystalline Au nanoparticles were distributed over the MOF matrix in a homogeneous fashion with a size of ca. 1–3 nm, evidenced by high resolution transmission

electron microscopy. In the case of Au/ZnO@MOF-5, the Au and metal oxide particles of a few nm in size were coexistent in a given volume of the MOF-5 matrix and were not separated in different crystalline MOF particles. For the TiO₂ loaded materials the oxide is preferentially located near the outer surface of the MOF particles, leading to an increase of larger exterior Au particles in comparison to very small interior Au particles as observed for the other materials. Au@MOF-5, Au/ZnO@MOF-5 and Au/TiO₂@MOF-5 were tested in liquid-phase oxidation of alcohols. Preliminary results show a high activity for the Au loaded materials in this reaction. This observation is attributed to the microstructure of the composites with very small Au particles distributed homogeneously over the MOF matrix.
