

Loading of porous metal–organic open frameworks with organometallic CVD precursors: inclusion compounds of the type $[L_nM]_a@MOF-5$

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The highly porous coordination polymer $[Zn_4O(bdc)_3]$ (bdc = benzene-1,4-dicarboxylate; MOF-5 or IRMOF-1) was loaded with typical MOCVD precursor molecules **1–10** for metals such as Fe, Pt, Pd, Au, Cu, Zn, Sn. Exposure of $[Zn_4O(bdc)_3]$ to the vapour of the volatile organometallic compounds, e.g. ferrocene (**3**), resulted in the formation of inclusion compounds of the type $[L_nM]_a@MOF-5$, where $[L_nM]$ indicates the MOCVD precursor and a denotes the effective number of molecules per cavity of the MOF-5 lattice. The obtained inclusion compounds were characterised by C/H combustion analysis, determination of the metal content by atomic absorption spectroscopy, FT-IR and solid state NMR spectroscopy and by powder X-ray diffraction. The data prove that the host lattice and the guest molecules interact only by weak van der Waals forces without any change of the framework or the chemical nature of the included molecules. Rapid desorption is observed for small and comparably volatile compounds such as pentacarbonyliron or diethyl zinc. Less labile inclusion compounds were obtained for cyclopentadienyl complexes as guest molecules, e.g. a rather high loading of six molecules of ferrocene per cavity was observed. Careful hydrolysis/calcination of $[Zn(C_2H_5)_2]_2@MOF-5$ resulted in the composite $(ZnO)_2@MOF-5$ pointing to the possibility to develop a subsequent chemistry of the embedded precursor molecules to yield novel nanocomposite materials based on MOFs as host matrices and MOCVD precursors in general.