Tailoring MOFs for CO_2 hydrogenation reactions

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Abstract
CO_2 hydrogenation to valuable products is an attractive research target and is thermodynamically favored by moderate temperatures (< 300 °C). At such temperatures, Metal Organic Framework (MOF) materials are potential candidates as single site catalyst and/or catalyst support, provided the stability issue is overcome.

In this contribution, focus is set on a series of Pt- and Pd-containing Zr-MOFs under study as CO_2 hydrogenation catalysts. Catalyst stability and elucidation of catalyst active state were studied by a combination of catalyst testing and characterization using XRD, N_2 adsorption, FESEM, TEM, XAS, NMR, CO chemisorption, IR spectroscopy and TGA.

Among the tested catalysts, extensive studies of Pt-based catalysts where Pt is grafted onto a bipyridine linker in a UiO-67 framework, showed that Pt is reduced to Pt metal nanoparticles of appx. 2 nm size during pretreatment in H_2 at 350 °C. Catalyst activity is positively correlated with the fraction of Pt(0), and the catalyst showed stable activity during 60 h of testing at 220-280 °C.[1] CO is the main, and primary, product, followed by CH_4. In a second set of experiments, improved selectivity to CH_4 was achieved by changing metal and linkers, and these results, as well as the corresponding effect on catalyst activity and stability will be presented.

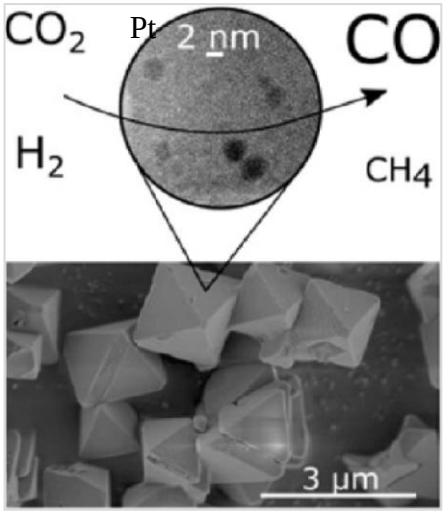

Figure adapted from [1].

Keywords: CO_2 valorisation, MOF, UiO-67

References

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