Reactive metal-support interaction of Cu and In_2O_3: its role in methanol steam reforming

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Methanol steam reforming (MSR) is one of the most promising reactions to provide hydrogen as a renewable energy carrier for automotive applications from an easily storable and distributable medium such as methanol. For a potential use of the produced H_2 in a fuel cell a high selectivity towards MSR, corresponding to low CO formation, is imperative. Besides oxide-supported systems intermetallic compounds have recently gained increased attention, with Pd-based systems being the most scrutinized representative. [1] These intermetallic compounds can either directly be synthesized or obtained *via* reactive metal-support interaction by (partial) reduction of the oxide support. [2] Since copper was already employed in numerous well performing catalysts in MSR, primarily suffering from deactivation by sintering, and indium oxide itself is capable of catalyzing methanol chemistry, these two materials were combined in this work. [3] The Cu-In_2O_3 system was investigated with respect to reactive metal-support interaction and the catalyst performance in MSR after different activation procedures was compared. Reduction of the calcined precursor in hydrogen at 300 °C yields metallic copper on indium oxide, which displays a high selectivity towards CO_2, but lacks activity. An increase in the reduction temperature to 400 °C leads to the formation of the intermetallic phase Cu_2In supported on In_2O_3, which is also highly CO_2-selective and exhibits an enhanced activity that is further improved with increasing number of MSR cycles conducted on this catalyst. [3]

[1] S. Sá et al. *Appl Catal B.* **99** (2010), 43-57.

[2] Penner S, Armbrüster M. *ChemCatChem.* **7** (2015), 374-392.

[3] K. Ploner et al. *Sci. Technol. Adv. Mater.* **20** (2019), 356-366.