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Microstructural investigations of ternary Cu/Zn/Al oxide catalysts for methanol steam reforming

P. Kurr, B. Kniep, R. Schlögl, T. Ressler

Fritz Haber Institute of the Max Planck Society, Department of Inorganic Chemistry, Faradayweg 4-6, 14195 Berlin

Binary Cu/ZnO and ternary Cu/ZnO/Al_2O_3 catalysts for methanol steam reforming have to be supported in an appropriate manner to obtain a homogenous microstructure of nanosized and well-intermixed Cu and ZnO particles. The latter are required to maintain the active copper phase in optimal dispersion without allowing segregation. Microstrain in the copper phase as the result of an intimate Cu/ZnO interphase was found to be an essential modification of bulk copper to achieve superior activity in both methanol synthesis and methanol steam reforming [1-4]. The modification occurs during thermal treatment of the precursor and can be adjusted by either the chemical composition [1] or by a proper preparation procedure at a constant chemical composition [2-4]. In addition, each step in the subsequent preparation (precipitation, aging, calcination) greatly affects the microstructure and is reflected in the catalytic performance of the final catalyst ("chemical memory" effect). Investigations on even more complex ternary Cu/ZnO/Al_2O_3 catalysts confirm that microstrain is an indicator of a homogeneous microstructure of superior copper catalyst in methanol chemistry. Adjusting a suitable homogenous microstructure will yield advanced catalysts and will eventually help to bridge the materials gap and provide the basis for a rational catalyst design.

DFG Priority Program: "Bridging the Pressure and Material Gap"

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[4] Kniep et. al., J. Catal. 236, 2005, 34