

The influence of strongly reducing conditions on strong-metal support interactions in Cu/ZnO catalysts used for methanol synthesis

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A systematic series of binary and ternary copper catalysts was investigated in methanol synthesis at atmospheric pressure. Strong metal-support interactions between copper and zinc oxide induced by strongly reducing conditions were probed by the adsorption of carbon monoxide which was monitored qualitatively and quantitatively by a combination of microcalorimetry, temperature-programmed desorption experiments and Fourier transform infrared spectroscopy. For the zinc oxide-containing catalysts, the pretreatment in flowing carbon monoxide at 493 K resulted in a severe decoration of the copper metal particles with ZnO_x adspecies, whereas after methanol synthesis at 493 K the state of copper was essentially identical to that after hydrogen reduction. Copper was always found to be present in its zero-valent state.