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The coverage-dependent adsorption of carbon monoxide on hydrogen-reduced copper catalysts: the combined application of microcalorimetry, temperature-programmed desorption and FTIR spectroscopy

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Abstract

The strong metal-support interactions occurring in Cu/ZnO catalysts are significantly influenced by the pretreatment. The objective of this contribution is to demonstrate that by carefully reducing binary Cu/ZnO and ternary Cu/ZnO/Al_2O_3 samples in hydrogen under the same conditions, the Cu metal surface is accessible in identical states to adsorption microcalorimetry, TPD experiments and transmission FTIR spectroscopy using carbon monoxide as probe molecule. All techniques show that a fully reduced and clean Cu surface is resulting from a thorough reduction in flowing high-purity hydrogen. The adsorption of CO on this Cu surface is fully reversible at room temperature, with heats of adsorption ranging between 70 kJ/mol at low coverages and 45 kJ/mol at high coverages.

Keywords: Copper; Adsorption; Carbon monoxide; Microcalorimetry; TPD; FTIR