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Activity and selectivity of a nanostructured CuO/ZrO_2 catalyst in the steam reforming of methanol

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Abstract:

Steam reforming of methanol for production of hydrogen can be carried out over copper based catalyst. In the work presented here, the catalytic properties of a CuO/ZrO_2 catalyst (8.5 wt%) synthesised by a templating technique were investigated with respect to activity, long term stability, CO formation, and response to oxygen addition to the feed. The results were obtained using a fixed bed reactor and compared to a commercial methanol synthesis catalyst $CuO/ZnO/Al_2O_3$. It is shown that, depending on the time on stream, the temporary addition of oxygen to the feed has a beneficial effect on the activity of the CuO/ZrO_2 catalyst. After activation, the CuO/ZrO_2 catalyst is found to be more active (per copper mass) than the $CuO/ZnO/Al_2O_3$ system, more stable during time on stream (measured up to 250 h), and to produce less CO. Structural characterisation by means of X-ray powder diffraction (XRD) and X-ray absorption spectroscopy (XAS) reveals that the catalyst (as prepared) consists of crystalline, tetragonal zirconia with small domain sizes (about 60 Angstrom) and small/disordered crystallites of CuO.

Keywords:

methanol steam reforming, template technique

Cu/ZrO_2, O-2 pulse, CO

formation COPPER-BASED CATALYSTS, ABSORPTION-SPECTROSCOPY,

$CU/ZNO/AL_2O_3$ CATALYST, PARTIAL OXIDATION, AL

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