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SYNTHESIS OF NANOSTRUCTURED MATERIALS FOR THE PRODUCTION OF CLEAN FUELS

Due to a need for obtaining energy from non-fossil sources, the use of dimethyl ether (DME) as a high-efficiency fuel is a promising alternative. Its use implies zero emissions of CO2 and other toxic compounds. In this study, we propose the synthesis and characterization of nanostructured materials based on transitions metals (W oxide), supported on alumina, to be used in the methanol dehydration reaction to produce DME. The materials were prepared by the precipitation method and characterized by X-ray diffraction (XRD), temperature-programmed desorption (TPD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), and X-ray photoelectron spectroscopy (XPS). The activity was discussed in terms of methanol conversion and selectivity towards DME. A tungsten oxide load at submonolayer coverage on alumina (Al2O3) renders highly dispersed dimeric polytungstate and isolated monotungstate species with tetrahedral, octahedral, and distorted octahedral coordination, whose proportion increases as it approaches a monolayer. Crystalline WO3 nanoparticles emerge at higher loads. All species displayed hexavalent oxidation. The 5 wt % sample showed the highest percentage of W-O-Al species, correlating with the highest methanol conversion. This is also attributed to the appearance of weak acid sites revealed by temperature-programmed ammonia desorption.

Keywords

Tungsten, Polytungstate and monotungstate, Nanomaterials, Submonolayer coverage

Reference

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