Structure and Reactivity of Vanadium and Molybdenum Oxide-Based Catalysts Supported on MgO-Coated SBA-15

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Supported metal oxides constitute model systems for investigating catalyst structure and performance. The structure of the surface catalysts is significantly affected by the properties of the support. Here, we investigated the influence of MgO-coated SBA-15 (MgO/SBA-15) with basic surface properties on the structure of vanadium and molybdenum oxide catalysts. X-ray absorption spectroscopy (XAS) and diffuse reflectance UV/Vis spectroscopy measurements showed that a similar structural motif was obtained for VOx and MoOx supported on MgO/SBA-15 at comparable catalyst loadings. The V and Mo species exhibited a tetrahedral arrangement of oxygen atoms around the metal centers. During calcination the formation of Mo dimers was observed. Supported V oxides formed dimers or chains at higher loadings. However, the connectivity of the catalyst units was low compared to oxides supported on SBA-15.[1,2] Activity in selective oxidation of propene was directly correlated to the number of bridging M–O–M bonds. A comparison of the V and Mo oxides showed a trend which was assigned to chemical composition rather than structural effects.

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YMnO₃-ZnO Thermoelectrics


Keywords: thermoelectric materials, hexagonal manganates, homologous compounds

Homologous compounds RMO₃(AO)ₙ (R = In, Sc, Fe, Ga, Y…; M = In, Ga, Al, Fe, A = Mg, Mn, Co, Zn, Fe) with alternated RO₂⁻ layers and MO(ZnO)ₙ⁺ blocks are fascinating thermoelectric materials allowing for control over transport properties.[1] In the present work we report on the synthesis, structure and thermoelectric properties of RMO₃(ZnO)ₙ (R = Y) (n = 0–10) oxides. The specimens were synthesized from Y₂O₃, Mn₂O₃, ZnO at 1200–1300 °C for 12 h in the air. Depending on the composition and the synthesis temperature, the formation of Mn-doped ZnO, spinel-type ZnMn₂O₄, hexagonal manganate YMnO₃ and two-phase compositions with an inversion domain boundary was confirmed by X-ray powder diffraction, TEM and Raman spectroscopy. The composition and structure of specimens determines their thermoelectric properties. Hexagonal manganate YMnO₃ possesses large positive thermopower that decreases with the increase in the temperature. In contrast, YMnO₃(ZnO)ₙ oxides (n > 1) show negative thermopower that remains nearly constant at 600–1200 K that is attributed to the predominant effect of the Mn-doped ZnO.

Figure 1. The thermopower of YMnO₃(ZnO)ₙ oxides.


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