ChemistrySelect

Propagation of a jam code signal in the conical-scan seeker processorHeterostructured redox-active V205/SnO2 oxide nanocatalyst for aqueous-phase oxidation of furfural to renewable maleic acid

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Abstract

In this paper, we report on the synthesis of heterostructured V2O5/SnO2 nanocatalysts with varying vanadium metal loadings of 5–30 wt%. The catalytic performance of the designed catalysts was evaluated in the oxidation reaction of furfural to maleic acid using hydrogen peroxide. The synthesis method afforded highly dispersed nanosized VOx species with predominant exposed V5+ and V4+ on SnO2 oxide. Such structural interface developments of the heterostructured V2O5/SnO2 catalyst resulted into modified electronic structure; phase compositions and textural properties of the individual V and Sn metal oxides with respect to varying V-metal loadings, which lead to improved catalytic performances. Under optimized reaction conditions, a 60% yield of maleic acid was achieved in furfural oxidation reaction. Based on characterization results, the high surface area and low V-metal loading (9.3 wt% vanadium) presented the most redox active V2O5/SnO2 catalyst. At low V-metal loadings the catalyst is populated with the presence of VOx monomeric and polymeric species which are proposed to induce the highly active vanadium sites. This was confirmed for the most active catalyst to possess vanadium with the predominant V4+ state and superoxide oxygen. The catalytic performance showed by V2O5/SnO2 present a solid catalyst derived from earth-abundant and cheap metals for the catalytic oxidation upgrade of biomass typical furfural to important value-added maleic acid intermediate chemical.