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Hetero-mixed TiO₂-SnO₂ interfaced nano-oxide catalyst with enhanced activity for selective oxidation of furfural to maleic acid

Petrus M. Malibo ^{a,b}, Peter R. Makgwane ^{a,b,*}, Priscilla G.L. Baker ^b

^a Centre for Nanostructures and Advanced Materials (CeNAM), Council for Scientific and Industrial Research (CSIR), Pretoria 0001, South Africa

^b Department of Chemistry, University of the Western Cape, Robert Sobukwe Drive, Private Bag X17, Bellville 7535, South Africa

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Abstract

Herein we report on the catalytic activity of hetero-mixed TiO₂-SnO₂ nano-oxide catalyst for the selective liquidphase oxidation of furfural to maleic acid using H₂O₂ oxidant. The high surface area and strong interaction of the two oxides with modified electronic structure manifested enhanced effective oxygen vacancies, and redox activity performance of the TiO₂-SnO₂ catalyst for furfural oxidation reaction. The structure of the catalyst was investigated by the powder X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), high-resolution transition electron microscopy (HRTEM), electron paramagnetic resonance (EPR) and Brunauer-Emmett-Teller (BET) surface area analyser techniques. The interfaced TiO₂-SnO₂ oxide catalyst was more catalytically active than its single counterpart SnO₂ and TiO₂ oxides to give a furfural conversion of 96.2% at up to 63.8% yield of maleic acid. The catalytic performance shown by TiO₂-SnO₂ present encouraging prospects for an economical solid metal oxide catalyst to access biobased maleic acid from renewable biomass-derived furfural.