

Ordered mesoporous WO_x/SnO_2 with excellent catalytic performance for producing bio-additives from acetalization of glycerol

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Highly ordered mesoporous WO_x/SnO_2 catalysts displaying excellent catalytic performance were demonstrated in the acetalization of glycerol with acetone. A series of WO_x/SnO_2 catalysts with varying WO_x loadings (5 ~ 20 wt%) were prepared by the wet-impregnation method using ammonium metatungstate as a W source. The synthesized catalysts were analyzed using various techniques including XRD, N_2 -isotherm, SEM, H_2 -TPR, Raman, and TGA analysis. For the acetalization of glycerol with acetone, $WO_x/meso-SnO_2$ with 20 wt% WO_x was found to be the most active catalyst, and the maximum conversion of glycerol (100%) was obtained after 2 h at 20 °C, providing 97.4% selectivity (97.4% yield) for the five-membered product, due to the presence of a large number of acidic sites on the surface of the catalyst. The catalytic activity of 20 wt% $WO_x/meso-SnO_2$ was also studied in a flow reactor. The catalytic results showed that, when the WHSV was 4 h^{-1} , both the glycerol conversion (100% to 97.9%) and solketal yield (97.5% to 93.6%) slightly decreased after 24 h of time-on-stream.