

Abstract

Vehicular SO_x emissions have a huge detrimental impact on public health, catalytic converters, and the environment. Developing strategies to remove sulfur from diesel and thus safeguard the above is imperative. A series of SnO_2 – MoO_3 mixed oxides and mono oxides MoO_3 and SnO_2 were prepared by soft template method, calcined at 450 °C and successfully tested in model diesel oxidative desulfurisation (ODS). The impact of the $\text{SnO}_2/\text{MoO}_3$ mole ratio (hereinafter denoted as Sn/Mo) on catalytic efficiency was investigated, among other catalytic parameters. The obtained samples were analyzed using X-ray diffraction (XRD), Raman spectroscopy, scanning electron microscopy (SEM), N_2 -physisorption and titration method for acidic properties. The study demonstrates that mixing SnO_2 and MoO_3 improves acidic sites, crystallinity, and morphological properties of pure SnO_2 . The addition of MoO_3 increased oxygen vacancies and the surface area of SnO_2 . High acidic site densities of 49.3, 47.4, and 46.7 mEqg^{-1} were observed for the catalysts with 2:1, 1:1, and 1:2 Sn/Mo mole ratio, respectively. The catalytic efficiency increased with an increase in Sn content with the highest catalytic efficiency of 99.8% for the dibenzothiophene (DBT) oxidation achieved in 30 min for Sn/Mo (2:1) catalyst compared to 92 and 70% for Sn/Mo 1:1 and 1:2 catalysts, respectively. The rate constant for the reaction was 0.057 min^{-1} , which is eight times that of MoO_3 ; 0.007 min^{-1} and three times that of SnO_2 ; 0.017 min^{-1} . The ODS mechanism utilizing the SnO_2 – MoO_3 catalyst was proposed. The prepared SnO_2 – MoO_3 catalyst demonstrated a high potential for industrial desulfurisation applications.

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