Synthesis of nanostructured vanadium phosphate catalysts using sonochemical route for partial oxidation of n-butane.

Abstract

In this study, sonochemical treatment is used to synthesize nanostructured vanadium pentoxide, V2O5 with different duration of time andmineralizers. Eight samples of V2O5 have been prepared using KN03 andKCl as mineralizers that undergo sonochemical treatment with different duration i.e., 30, 60, 90 and 120 min, respectively. These samples were denoted as KNO30, KNO60, KNO90, KNO120, KC130, KC160, KC190 and KC1120. Nanostructured V2O5 prepared via ultrasound irradiation for 30 min in KC1 (KC130) was chosen as starting material to synthesis vanadium phosphorus oxide catalyst (denoted VPOS30KC1). All the materials synthesized was characterized by using X-Ray Diffraction (XRD), Brunauer-Emmett-Teller surface area measurement (BET), chemical analysis, Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM) and temperature programmed reduction (H2-TPR). Catalytic properties for n-butane oxidation of the catalyst, VPOS30KC1 was investigated by using a fixed-bed microreactor at 673 K (GHSV = 2400 h1). SEM micrographs show that the morphology of the V2O5 changed from platelet-like particles intonanorods after 90 min of sonochemical treatment. XRD patterns detected that the potassium ion from the mineralizers was incorporated into the V2O5 structure after prolonged sonochemical treatment duration. H j-TPR profiles shown that VPOS30KC1 gave higher amount of reactive oxygen species (0-V4+) removed which will expect to give higher activity. Catalytic evaluation showed that VPOS30KC1 gave higher conversion (19%) while retaining the selectivity towards maleic anhydride (48%) compared to the bulk VPO catalyst prepared in the same organic medium (XC4: 14%).

Keyword: Sonochemical treatment; Ultrasound irradiation; Vanadium phosphorus oxide; Butane oxidation.