

FUNCTIONALISED PROPANE THROUGH SELECTIVE OXIDATION OVER MoVTeNbO_x CATALYST: EFFECT OF WATER VAPOR TOWARDS CATALYTIC ACTIVITY**M.A. Afandi^{1,2,3*}**, R. Irmawati^{1,2}, M.I. Saiman^{1,2}, Y.H. Taufiq-Yap^{1,2}, A.Z. Ismail^{1,2}, W. Ueda⁴¹Catalysis Science and Technology Research Centre, Faculty of Science, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia²Department of Chemistry, Faculty of Science, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia³Department of Chemistry, Center for Foundation Studies, International Islamic University Malaysia, 26300 Gambang, Pahang, Malaysia⁴Catalysis Research Centre, Hokkaido University, N-21, W-10, Sapporo 001-0021, Japan

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ABSTRACT

Selective oxidation of short-chain alkane to oxygenates, although promising, was not well studied until the 90's. Although highly challenging, selective oxidation reaction found to be advantageous and could revolutionise the process and commercialisation of bulk chemicals supply in the industry. One example is acrylic acid, currently synthesised by a two-step process is an essential intermediate for the chemical, petrochemical and consumable industry. It can also be produced through selective oxidation of propane over MoVTeNbO_x catalyst. Although challenging, this direct one-step process has attracted researchers and industrialists community due to the energy and environmental conservation concern. This has made research to fine-tune the process and catalyst for this reaction intensified in the recent moment. In this work, four MoVTeNbO_x catalysts were synthesised in different pH ranging from 1 to 3.5. The resulting catalysts have been characterised by X-ray powder diffraction (XRD), Brunauer-Emmett-Teller (BET) Surface Area Analysis, Temperature Program Reduction (TPR-H₂) and Scanning Electron Microscopy (SEM) for surface morphology. The XRD results showed that the catalysts contained highly pure M1 phase with the surface area is in the range of 21.56 - 40.11 m²/g. The SEM results show the only single morphology of rod shape in accordance with an M1 phase which is found present in high purity. After being characterised, the catalysts were subsequently used in the partial oxidation of propane to acrylic acid. The catalytic studied was carried out by using a fixed-bed Pyrex tubular reactor at atmospheric pressure. Effect of reaction temperature and percentage of water were investigated. From the catalytic test, it was revealed that the MoVTeNbO_x catalysts are useful for partial oxidation of propane to acrylic acid. The catalytic results show the conversion of propane in the range of 34.4 to 39.6 % and the selectivity of the acrylic acid 19.0 - 25.0 %.

Keywords: M1 phase, MoVTeNbO_x, Propane, Selective Oxidation, Acrylic Acid