CATALYSIS ON POROUS MATERIALS

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Effect of preparation method on nature and distribution of vanadium species in vanadium-based hexagonal mesoporous silica catalysts: Impact on catalytic behaviour in propane ODH

R. Bulánek, P. Čičmanec, H. Sheng-Yang, P. Knotek, L. Čapek, M. Setnička

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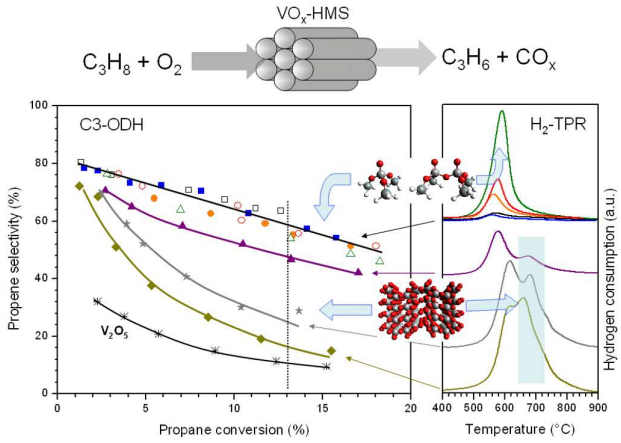

Abstract: This work reports comparative study of catalytic performance of VOx-HMS catalysts prepared by ethanolic impregnation method and direct synthesis. In order to detailed investigation of vanadium speciation depending on vanadium content and its impact on catalytic behavior in C3–ODH, number of samples in wide range of vanadium content (1–16 wt.%) was prepared by both types of preparation. Prepared catalysts were tested in the oxidative dehydrogenation of propane at 540 ◦C under different contact times and catalytic results were correlated with physicochemical characteristics of the catalysts examined by XRD, XRF, SEM, N2 adsorption/desorption isotherms, H2-TPR and DR-UV–visible spectroscopy. Study led to conclusion, that (i) both monomeric VOx complexes and oligomeric VOx complexes with tetrahedral coordination containing V O V bonds are active and selective catalytic sites for C3–ODH, (ii) active VOx species are characterized by distinct reduction peak in H2-TPR pattern centered at 570–590 ◦C, (iii) VOx- HMS vanadosilicates can be directly synthesized under ambient conditions without need for autoclave in wide range of vanadia loading with preservation of good catalytic performance and (iv) the catalytic results in C3-ODH were significantly better for synthesized catalysts compared to impregnated catalysts resulting in three times higher propene productivity of the best synthesized catalyst compared to the best impregnated one under the same reaction conditions. The higher is vanadium loading the more distinct is the difference in catalytic performance of both types of catalysts.