

Generation of Catalytic Films of Zeolite Y and ZSM-5 on FeCrAlloy Metal

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Abstract : This work details the generation of thin films of structured zeolite catalysts (ZSM-5 and Y) onto the surface of a metal substrate (FeCrAlloy) using in-situ hydrothermal synthesis. In addition, the zeolite Y is post-synthetically modified by acidified ammonium ion exchange to generate US-Y. Finally the catalytic activity of the structured ZSM-5 catalyst films (Si/Al = 11, thickness 146 μm) and structured US-Y catalyst film (Si/Al = 8, thickness 23 μm) were compared with the pelleted powder form of ZSM-5 and USY catalysts of similar Si/Al ratios. The structured catalyst films have been characterised using a range of techniques, including X-ray diffraction (XRD), Electron microscopy (SEM), Energy Dispersive X-ray analysis (EDX) and Thermogravimetric Analysis (TGA). The transition from oxide-on-alloy wires to hydrothermally synthesised uniformly zeolite coated surfaces was followed using SEM and XRD. In addition, the robustness of the prepared coating was confirmed by subjecting these to thermal cycling (ambient to 550°C). The cracking of n-heptane over the pellets and structured catalysts for both ZSM-5 and Y zeolite showed very similar product selectivities for similar amounts of catalyst with an apparent activation energy of around 60 kJ mol⁻¹. This paper demonstrates that structured catalysts can be manufactured with excellent zeolite adherence and when suitably activated/modified give comparable cracking results to the pelleted powder forms. These structured catalysts will improve temperature distribution in highly exothermic and endothermic catalysed processes.

Keywords : FeCrAlloy, structured catalyst, zeolite Y, zeolite ZSM-5

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