Promoted V2O5/TiO2 catalysts for selective catalytic reduction of NO with NH3 at low temperatures - DTU Orbit (30/12/2018)

Promoted V2O5/TiO2 catalysts for selective catalytic reduction of NO with NH3 at low temperatures

The influence of varying the V2O5 content (3–6 wt.%) was studied for the selective catalytic reduction (SCR) of nitrogen oxides by ammonia on heteropoly acid (HPA)- and tungsten oxide (WO3)-promoted V2O5/TiO2 catalysts. The SCR activity and alkali deactivation resistance of HPA-promoted V2O5/TiO2 catalysts was found to be much higher than for WO3-promoted catalysts. By increasing the vanadium content from 3 to 5 wt. % the catalysts displayed a two fold increase in activity at 225 °C and retained their initial activity after alkali doping at a molar K/V ratio of 0.181. Furthermore, the catalysts were characterized by N2 physisorption, XRPD, NH3-TPD, H2-TPR, Raman, FTIR, and EPR spectroscopy to investigate the properties of the catalysts. XRPD, Raman and FTIR showed that promotion with 15 wt.% HPA does not cause V2O5 to be present in crystalline form, also at a loading of 5 wt.% V2O5. Hence, use of HPAs does not cause increased N2O formation or unselective oxidation of NH3. NH3-TPD showed that promotion by HPA instead of WO3 causes the catalysts to possess a higher number of acid sites, both in fresh and alkali poisoned form, which might explain their higher potassium tolerance. Ex-situ EPR spectroscopy revealed that HPA-promoted catalysts have higher V4+/Vtotal ratios than their WO3-promoted counterparts. H2-TPR suggests that HPAs do not have a beneficial effect on the V5+/Vtotal redox system, relative to WO3.

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