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Comparative analysis on monolithic DeNOx catalysts

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Catalysts based on the vanadia-titania system are widely used for the abatement of pollutants, particularly nitrogen oxides (NOx), in the exhaust gases of industrial plants. Their mechanism of operation is based on the catalytic reduction reaction of nitrogen oxides with ammonia (SCR). In this paper, two commercial catalysts based on the V-W-Ti system of very similar nominal composition were compared. The two samples were analyzed in the fresh state and after a period of operation in a waste gas plant of a waste to energy plant. The materials were first characterized from the chemical structural point of view through instrumental techniques such as X-ray fluorescence (XRF), X-ray diffractometry (XRD), IR spectroscopy (FTIR), SEM scanning electron microscopy observations with analysis EDS, measurement of pore size and specific surface area through nitrogen adsorption/desorption and BET techniques. Subsequently, the catalytic properties of the new and used catalysts in the NH_3-SCR reaction were evaluated. The results of the analysis showed that the samples are both made of a titanium matrix in the form of anatase, reinforced with glass fibers used as a support for the active phases based on V and W. The percentages of vanadium are practically the same for both systems, while the tungsten percentage is very different. The specific surface also has very similar values for the two fresh catalysts. The tests of catalytic activity, on the other hand, have given very different results particularly, for one of the two catalysts the performance decays much faster than the other. The kinetic measurements show that the decay is not due to a specific surface decrease but due to the presence of precipitates, but to a difference in initial activity between the two catalysts, linked to the different tungsten content.

Recent Publications

1. M O Guerrero-Perez (2017) Supported, bulk and bulk-supported vanadium oxide catalysts: a short review with an historical perspective. Catalysis Today 285:226–233.
2. Svachula J, Alemany L J, Ferlazzo N, Forzatti P, Tronconi E and Bregani F (1993) Oxidation of SO_2 to SO_3 over honeycomb DeNoxing catalysts. Industrial & Engineering Chemistry Research 32(5):826–834.
3. Xi Y, Ottinger N A and Liu Z G (2014) New insights into sulfur poisoning on a vanadia SCR catalyst under simulated diesel engine operating conditions. Applied Catalysis B: Environmental 160–161(1):1–9.
4. Chen J P and Yang R T (1992) Role of WO_3 in mixed V_2O_5-WO_3/TiO_2 catalysts for selective catalytic reduction of nitric oxide with ammonia. Applied Catalysis A: General 80(1):135-148.
5. Zhang S and Zhong Q (2015) Surface characterization studies on the interaction of V_2O_5–WO_3/TiO_2 catalyst for low temperature SCR of NO with NH_3. Journal of Solid State Chemistry 221:49–56.

Biography

Giovanni Perillo has completed his Graduation in Civil Engineering at the University of Naples Federico II, Italy. He is a Professor at University of Naples Parthenope and Adjunct Professor at Wessex Institute of Technologies, New Forest (UK). He has been involved in several world-wide international research projects and he is an author of more than 100 scientific publications in varied fields of engineering. He is currently a member of several International Advisory and Scientific Committees. He is a Member of Editorial Board of the Journal of Energy Engineering Science and Journal of Hydrology Science from publishing group, New York, USA and Reviewer of Journal China-USA Business Review of Horizon Research Publishing. He also planned many high technical engineering projects. Since 1996, he is a member of National Geographic Society and a member of New York Academy of Sciences. He was also a Chairman of Italian National Environment Commission.

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