

Master project

PSI, Bioenergy and Catalysis Laboratory, Villigen PSI

Hydrothermal aging procedure of SCR catalysts under constant flow

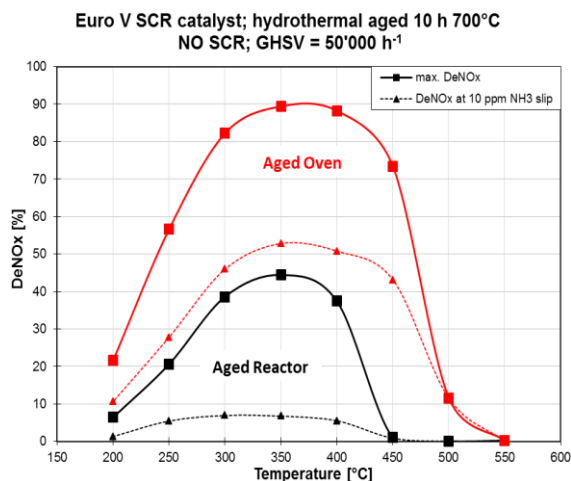
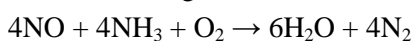


Fig. 1: DeNO_x of a standard V-SCR cat.

The selective catalytic reduction (SCR) of NO_x by NH₃ is up to date the most efficient post treatment method for reducing nitrogen oxides emissions. Toxic NO_x are reacting with injected ammonia to form nitrogen and water according to the reaction:



A typical SCR catalyst consists of a support material such as TiO₂, promoters like WO₃ and SiO₂ as well as the active species based on V₂O₅. These catalysts, used in stationary as well as mobile sources, normally exhibit a lifetime up to 5 years. In order to mimic a long term use of working catalysts, laboratory aging procedures have to be developed.

Since temperature is one parameter that affects the catalyst lifetime, often a high calcination temperature is chosen for its aging. To that end, also moisture (exhaust gas normally consists of around 10% H₂O) is affecting the performance and durability. Preliminary tests in our lab have shown that the aging is even more severe when a catalyst is hydrothermally aged under a constant flow (Figure 1).

The aim of the project is to investigate different aging procedures of standard and novel V-based catalysts. The influence of H₂O as well as the aging under a constant flow will be tested on monolith and powder SCR catalysts. Additional information will be obtained from BET, XRD, XRF and DRIFTS in order to find correlations between structural properties and the catalytic activity as a function of the aging protocol.

Tasks

- Implementing an aging procedure for hydrothermal aging
- Characterization using XRD, XRF, BET and infrared spectroscopy
- Catalytic activity measurement of powder and washcoated catalysts

Benefits

- Training in the use of catalytic reactor set up and standard characterization techniques
- Learning to write scientific reports and to present results on conferences/workshops
- Work in the international team

Type of work: Master

Application: automotive catalysis

Nature of work: experimental

Requirements: interests in chemistry, materials science, lab-work, characterization methods, catalysis

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