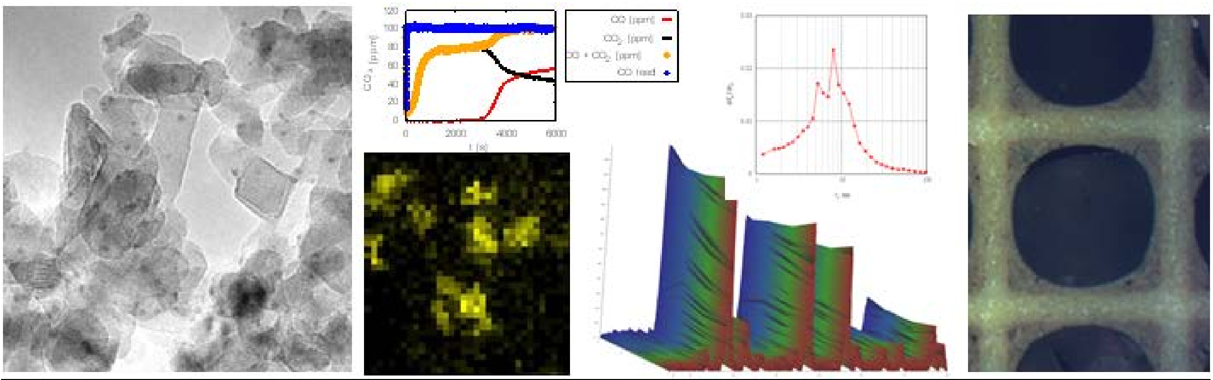
Lean NOx trap (LNT) catalyst

Background: Due to limited fossil fuel resources and the necessity of reducing CO_2 emissions, fuel efficient diesel and lean burn engines gain in importance. However, under these operation conditions, the abatement of NO_x emissions is a challenge to exhaust gas after-treatment. For passenger cars and light duty applications, the NO_x trap technology is a promising approach. NO_x storage/reduction (NSR) catalysts generally comprise three main components: (i) noble metals (Pt, Pd, Rh) as catalytic active components for oxidation and reduction reactions, (ii) alkali or alkaline earth metals as NO_x storage material (typically Ba), and (iii) an oxidic high surface area support (e.g. CeO_2, ZrO_2, Al_2O_3). The NO_x trap technology requires alternating lean/rich conditions. During the lean period, NO_x is stored in the storage components in form of nitrates and nitrites. In the subsequent, short fuel-rich period, the NO_x trap is regenerated by NO_x release and reduction to N_2. Since fuel consumption for NO_x trap regeneration depends on the regeneration frequency, which is a function of NO_x trap performance parameters, the impact of catalyst aging must be considered in the operation strategy.



LNT characterization

Project: The aim of the present project is the development of a model which considers changes caused by aging. The main influence quantities of the activity decrease shall be identified by catalyst characterization on the one hand and experimental investigations on the activity of reactive and storage components on the other hand. We use various characterization techniques to determine the physical and chemical properties of differently pretreated catalyst samples. The change of the noble metal dispersion due to aging is determined by means of CO-chemisorption. Furthermore, we use N_2-physisorption to gain information about the washcoat porosity and the pore shapes. The BET method is applied to determine the specific surface area and the mean pore diameter, while the use of the BJH model provides information about the pore size distribution. The influence of catalyst aging on the crystalline phases is detected by XRD. We use the Full Pattern Matching (FPM) model for determination of the Scherrer crystallite sizes and for quantitative analysis. Furthermore, we have the possibility to trace phase changes by *insitu*-XRD. HRTEM combined with SAED provides further information on the crystalline phases, while STEM/EDX mapping reveals the distribution of the elements within the washcoat. Hence, with these techniques we can trace the changes of the particle and agglomerate sizes of the catalytic active components.

Co-workers: Denise Chan

Collaboration: K. Hauff, U. Nieken, Universität Stuttgart

Funding: Forschungsvereinigung Verbrennungskraftmaschinen (FVV) e.V.

Selected publications: W. Boll, K. Hauff, U. Nieken, G. Eigenberger, O. Deutschmann. Forschungsvereinigung Verbrennungskraftmaschinen (FVV) e. V., Heft R 551, (2010) p. 111-142, Frankfurt am Main, Germany; V. Schmeißer, G. Eigenberger, J. Koop, O. Deutschmann. Forschungsvereinigung Verbrennungskraftmaschinen (FVV) e. V., Heft R 537, (2007) p. 59-84, Frankfurt am Main, Germany.