Methods to Enhance Low Temperature $DeNO_x$ Performance

The scope of the FVV study was to assess a broad variety of current state-of-the-art technology solutions for reducing nitrogen oxide emissions of internal combustion engines by means of a comprehensive literature and patent review. The focus here was on increasing the conversion rates of aftertreatment systems effected at low exhaust gas temperatures. The potential NO_x reduction measures had been divided into four different categories, i.e. "periphery", "catalysis", "preparation of reducing agent" and "engine internal measures". For each single solution, a detailed technology briefing including pros and cons was prepared to specify its purpose, its mode of operation and its integration into the IC engine system. The assessment of the emission reduction technologies together with their supporting measures was carried out with the help of systematically identified requirements on the engine system and respective boundary conditions. Basically, a distinction was made between the evaluation of the functionality of a technology and its system implementation. Low temperature activity, interaction with the environment, dynamics, long-term durability and the need for exhaust gas recirculation were chosen as essential criteria for assessing its functionality. The system performance of each single technology was assessed against criteria such as fuel consumption / CO_2 balance, serviceability / health and safety, durability / robustness, environment, development effort, implementation effort and suitability for series production. In addition, all technology solutions were evaluated with a view to four different fields of IC engine application, as there are passenger cars, commercial vehicles, nonroad mobile machinery and lean-burn engine driven stationary installations. For this purpose, a reference system for each application was drawn up representing the current state of the art and serving as evaluation basis. Moreover, a series of technologies were identified that have the potential to further enhance the $DeNO_x$ performance and/or enlarge the working temperature range of a system. Upon completion of the project engine manufacturers, technology providers and research centres have access to a comprehensive common rating matrix plus inherent conclusions on a multitude of technologies enabling the researchers to work on different $DeNO_x$ solutions in the long term while pursuing individual development targets.

Periphery:
Electrically heated ring catalytic converter

RESEARCH INSTITUTE: COMBUSTION ENGINES AND EMISSION CONTROL LABORATORY (CEEC), OTH REGENSBURG CHAIRPERSONS: LISA ZIMMERMANN, EBERSPÄCHER EXHAUST TECHNOLOGY GMBH & CO. KG, AND DR MARTINA REICHERT, FORD FORSCHUNGS-ZENTRUM AACHEN GMBH

Platinum-Palladium Catalysts: De- and Reactivation

Previous findings on the conversion behaviour of diesel oxidation catalysts (DOCs) from two preceding FVV research projects – Catalyst Simulation and KASPar – refer to a monometallic pt-based DOC. In the fleet depending on the application, however, bimetallic pt-pd-based technologies are often used, too. Thus, the aim of this FVV project was to investigate more closely the extent to which the palladium content influences the kinetics, i.e. the reaction mechanisms and kinetic parameters, and to learn whether this physical mechanism can be described. Furthermore, the bimetallic catalysts exhibit a fundamentally different conversion behaviour both in the fresh and in the aged state. In the case of aging, the characteristic variables, such as, for example, the noble metal dispersion or average particle sizes, are particularly effected. A secondary project objective was therefore to verify the transferability of the current findings on monometallic pt-based DOCs to pt-pd-alloyed catalysts and to examine their aging behaviour. In addition, the model parameterisation was quantified and the effect of noble metal oxide formation was examined more in detail. Previous observations on pt-only DOCs revealed a strong influence (hysteresis) on the kinetics. Consequently, the effect on palladium was investigated and quantified. The results of the characterisation of the mixed catalyst have yielded a great diversity of different noble metal particles in composition and structure. As it seems to be very difficult to combine them into a few representative parameters as part of a kinetic model development, it might be useful to investigate in a follow-up project, from a physically and chemically point of view, on specific noble metal particles the alterations that the catalyst undergoes in addition to noble metal oxide formation and reduction.

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FVV – RESEARCH ASSOCIATION FOR COMBUSTION ENGINES E.V.

The FVV was founded in 1956 and has developed into a worldwide and unique network for engine and turbine research. It promotes pre-competitive joint research projects for this industry, bringing together industry experts and scientists to ensure continuous improvements in the efficiency and emissions of engines and turbines – to the benefit of our economy, our environment and our society as a whole. Furthermore, it provides support for junior researchers. Its members are small, medium-sized and large companies in the industry: automotive companies, engine and turbine manufacturers and their suppliers.

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