SINCHEM doctoral research subject

Coupling of soot oxidation and ammonia-mediated selective catalytic reduction of nitrogen oxides.

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PROJECT DETAILS:

Advanced diesel combustion engines have higher net efficiencies as well as lower NO_x and particulate matter (PM) emissions than current ones, together with an exhaust gas temperature which is lower than that of today's engines. The combination of low temperature and NOx levels that still require abatement, poses a significant challenge for diesel engine after-treatment. Furthermore, space limitations in nowadays light-duty diesel engine vehicles, are forcing car manufacturers to seek for solutions that combine different functionalities into single converters. A possible solution is the embodiment of the NO_x selective catalytic reduction (SCR) functionality in the already present diesel particulate filter (DPF), in the so-called SCR-on-Filter (SCRoF), and is achieved by depositing the SCR catalyst in the inner porosities of the filter walls, or on the top of them. The NO_x are reduced through the addition of NH_3. Whereas, soot accumulates on the filter walls, as in a conventional DPF, and is regenerated either by passive regeneration (through the effect of NO2-assisted soot oxidation) or active regeneration (through the increase of the upstream gas temperature in the Diesel Oxidation Catalyst –DOC– up to around 600°C to promote soot oxidation). The SCRoF can take advantage of the concomitant SCR reaction for NOx abatement and the passive soot regeneration occurring in the filter. When gas temperatures and NO_2 levels are adequate, the latter exploits NO_2-mediated soot oxidation, which reduces the NO_2 content in the gas flow by converting it to NO; on the other hand, the SCR reaction completes the NO+NO_2 reduction to N_2.

The thesis is focused on the design of a multi-functional catalyst for the oxidation of soot and the NH_3-SCR of NO_x, that promotes NO to NO_2 oxidation (which is relevant to increase the rete of SCR reactions and promotes soot oxidation), but avoids excessive NH_3 oxidation (which would be detrimental for the NOx reduction activity).