



REWARD

REal World Advanced Technologies for Diesel Engines

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Project partners:

- 1 - AVL - AVL List GmbH - AT
- 2 - REN - Renault SAS - FR
- 3 - VCC - Volvo Car Corporation - SE
- 4 - CRF - CRF SCpA - IT
- 5 - CNRIM - Istituto Motori – Consiglio Nazionale delle Ricerche (CNR) - IT
- 6 - JM - Johnson Matthey Plc - UK
- 7 - RIC - Ricardo Plc - UK
- 8 - SCF - Schaeffler AG - DE
- 9 - LMM - Le Moteur Moderne - FR
- 10 - DELPHI - Delphi Automotive Systems Luxembourg S.A. - LU
- 11 - UNR - Uniresearch BV - NL
- 12 - IFPEN - IFP Energies Nouvelles - FR
- 13 - VIF - Virtual Vehicle Research Center - AT
- 14 - CTH - Chalmers Tekniska Högskola - SE
- 15 - CTU - Czech Technical University - CZ
- 16 - UPVLC - Universitat Politecnica de Valencia – Motores Termicos - ES

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Publishable Executive summary

In this work we have studied the effect of soot on ammonia storage, ammonia oxidation and ammonia selective catalytic reduction (SCR) over SCR coated filters. In order to do so, we have started with synthesizing state of the art SCR material, Cu/SSZ-13. We have used XRD to verify the structure, BET surface area was measured to ensure high surface area and pore volume and ICP-SFMS for the elemental composition. This material was thereafter coated on small cordierite monolith substrates. The produced monolith catalysts were thereafter used to study the ammonia storage, ammonia oxidation and ammonia SCR. Moreover, soot from engine rig experiments from Volvo Cars, was applied on the catalyst and the effect of soot on the different reactions were examined. In addition, the regeneration of soot, i.e. soot oxidation, was studied for different gas compositions. The most important findings are summarized in the list below:

- Ammonia storage was slightly increased in the presence of soot. During the ammonia desorption the peak was slightly larger at higher temperatures, indicating that ammonia storage on soot has a strong binding energy.
- The SCR experiment, as well as ammonia oxidation, showed that the activity of Cu/SSZ-13 was not influenced by the presence of soot using a soot loading of 10 g/l.
- Soot oxidation started at 350 and 400 °C, but only to a very small extent. However, at 500 °C large soot oxidation is seen, which rapidly increased when increasing the temperature to 600 °C.
- Comparing soot oxidation with and without water it is clear that the presence of water increases the soot oxidation.
- When comparing the results for O_2+H_2O with $O_2+H_2O+NH_3$ it is clear that the soot oxidation is lowered in the presence of ammonia, resulting in larger integrated CO_x at 500 °C for O_2+H_2O , while opposite results at 600 °C was received where more was oxidised for $O_2+H_2O+NH_3$. Thus the presence of ammonia reduces the soot oxidation, which is in line with the ammonia TPD results where we found ammonia storage on the soot.
- During ammonia SCR conditions the activity for soot oxidation is regained at 500 °C, compared to the ammonia oxidation case. At this high temperature the SCR zone is very short, thus the majority of the catalyst is not exposed to ammonia and therefore the inhibition effect of ammonia is not observed.

To conclude, a kinetic model for standard SCR condition do not need to include soot inhibition. Interestingly, the gas composition influences the soot oxidation. Therefore, must the effect of gas composition be included when modelling the regeneration of the coated particulate filter from soot, i.e. during soot oxidation. This will be done in the continuation of the subtask 2.1.2. The delivery D2.2 contains the experimental results that will be the base for the model.