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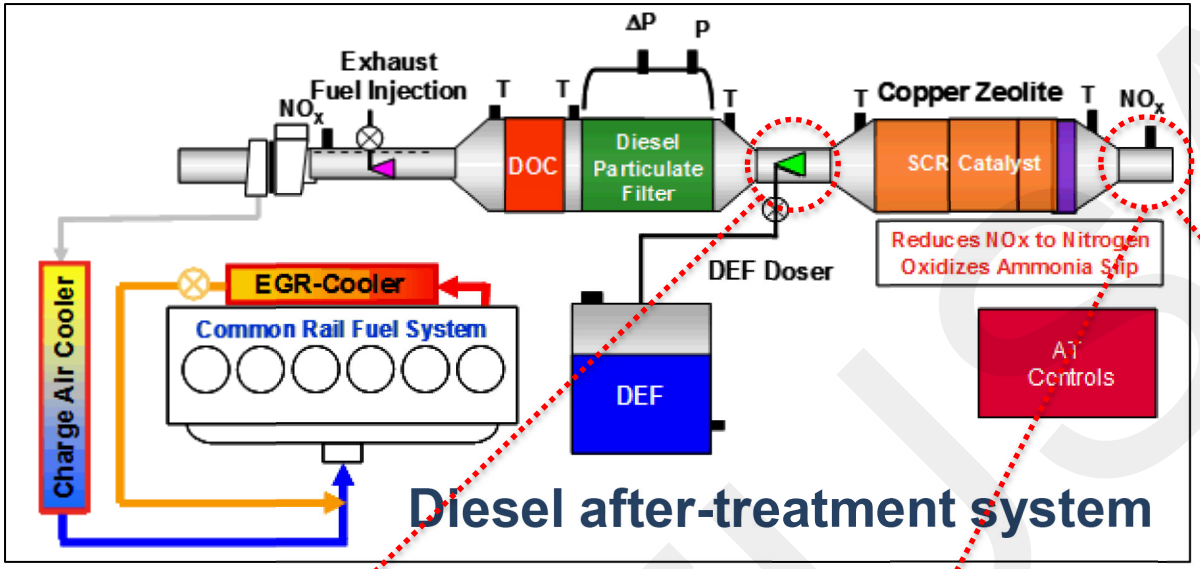
Impact of diesel emission fluid soaking on the performance of Cu-zeolite catalysts for diesel NH_3-SCR systems

Dong-wei YAO

College of Energy Engineering, Zhejiang University

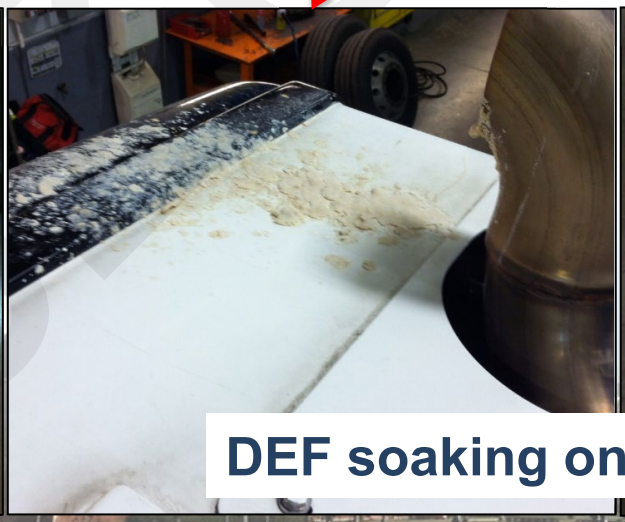
Department of Agricultural and Biological Engineering, University of Illinois at Urbana-Champaign

DEF soaking and urea deposit issues in real application







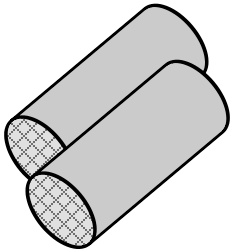




Experimental method

Sample preparation

Experimental design of DEF soaking



Cu-zeolite based SCR catalyst samples (Cu-SAPO-34)

Hydrothermally Degreening
At 700 °C for 4 hours

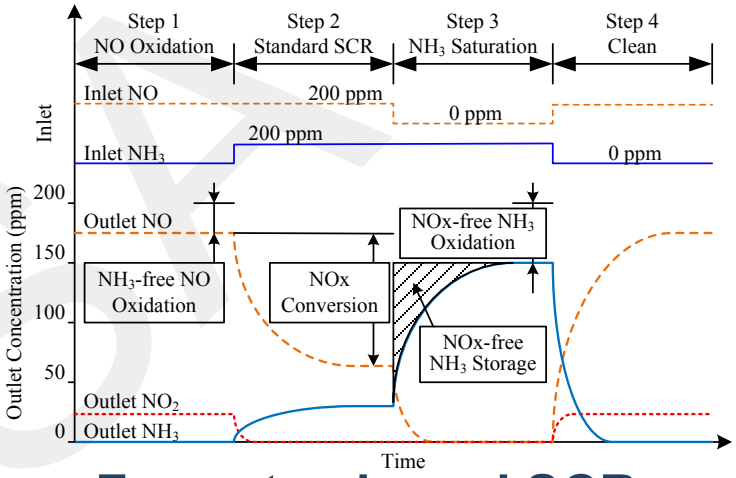
DEF Impregnation
For 1, 2 hours then Blown dry

Hydrothermally Treatment
Up to 550 °C for 2 hours

Performance Evaluation Test (Four-step based)

Feeding gas: 7 vol.% H_2O, 8 vol.% CO_2, 10 vol.% O_2 0/200 ppm NO, 0/200 ppm NH_3 and a balance gas of N_2 ;
Temperature range: 200 °C to 550 °C;
GHSV: 60000 h^{-1}.

Entire experimental procedure

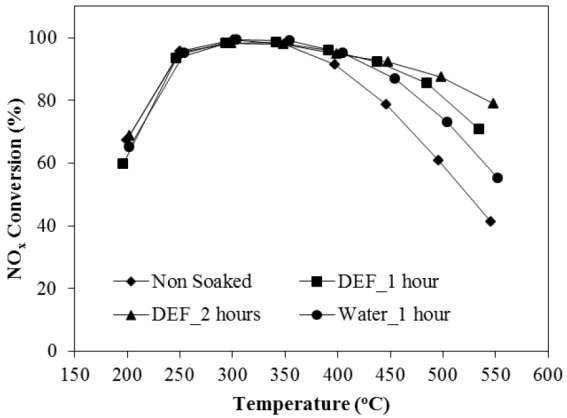


Four-step based SCR catalyst performance test

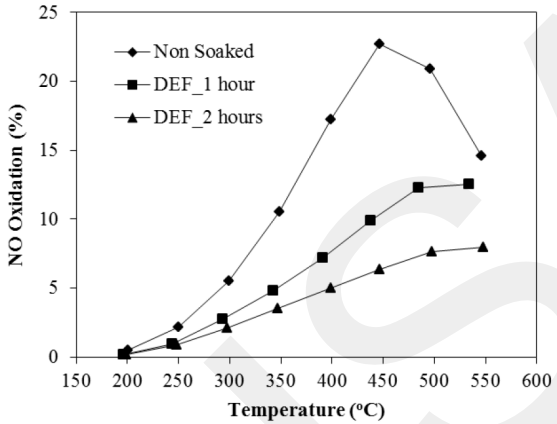
SCR catalyst samples

Catalyst Material	Cu-zeolite (Cu-SAPO-34)
Core Diameter (cm)	2.54
Core Length (cm)	5.08
Cell Density (CPSI)	400

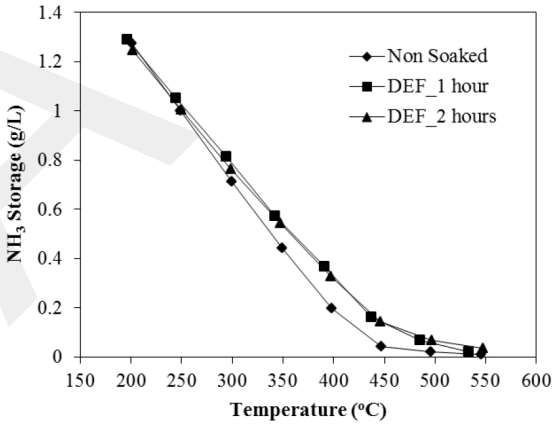
Results and discussion



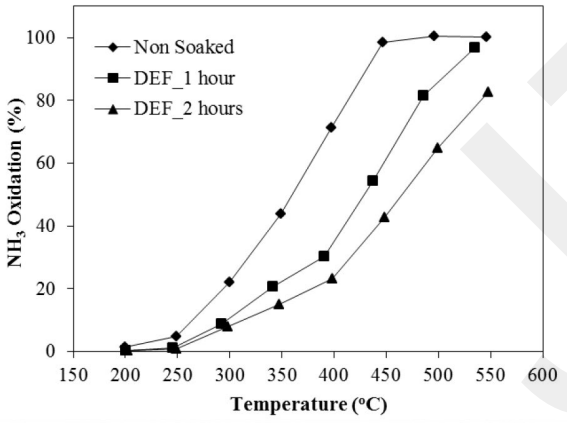
NO_x conversions of SCR catalyst samples



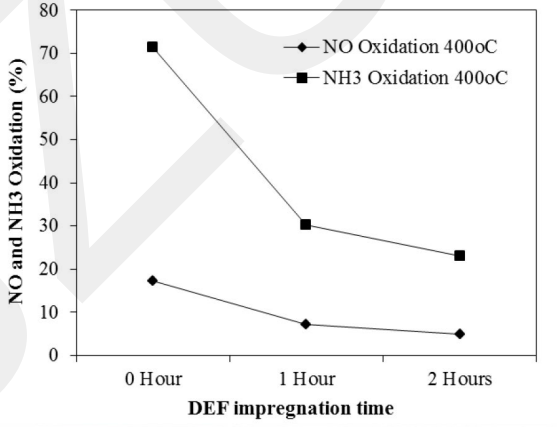
NH_3-free NO oxidations of SCR catalyst samples



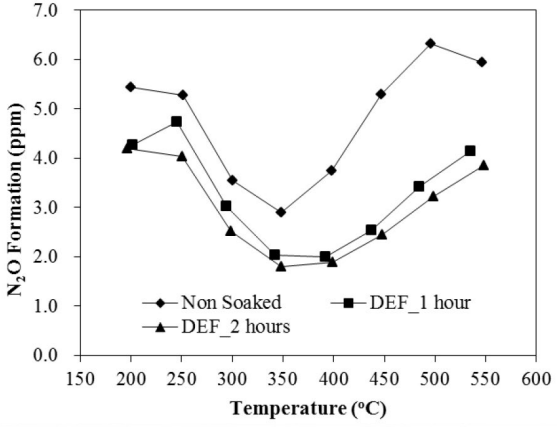
NO_x-free NH_3 storage level of SCR catalyst samples



NO_x-free NH_3 oxidations of SCR catalyst samples



NO and NH_3 oxidations of SCR catalyst samples with different DEF impregnation time



N_2O selectivity of SCR catalyst samples

Conclusions

- DEF soaking leached some Cu from the SCR catalysts and slightly reduced their Cu loadings.
- The loss of Cu and associated metal sites on the catalysts weakened their catalytic oxidation abilities and caused lower NO/NH_3 oxidation and lower high-temperature N_2O selectivity.
- Lower Cu loading also made the catalysts less active to the decomposition of surface ammonium nitrates and decreased low-temperature N_2O selectivity.
- Cu loss during DEF impregnation released more acid sites on the surface of the catalysts and increased their acidities, and more NH_3 was able to be adsorbed and involved in SCR reactions at medium and high temperatures.
- Due to lower NH_3 oxidation and higher NH_3 storage, the DEF-impregnated SCR catalyst samples showed higher NO_x conversion above 400 ^oC compared with the non-soaked one.
- The negative impact of urea deposits during DEF impregnation was not clearly observed, because the high-temperature hydrothermal treatment helped to remove the urea deposits.