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Role of NH_3 oxidation in NO_x reduction performance of dual-layer and mixed LNT-SCR configurations

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Abstract

A global kinetic model for NH_3 oxidation is developed and incorporated into an existing LNT-SCR kinetic model to study its effect on the performance of dual-layer and mixed LNT-SCR configurations. The model predicts a decrease in the NO_x conversion and an increase in the NO_x storage with the inclusion of NH_3-oxidation reactions for both the configurations. This is due to the selective oxidation of NH_3 on the LNT catalyst instead of its consumption by the NO_x reduction reactions on the SCR catalyst. The decrease in NO_x conversion is negligible at low temperatures and is more prominent at intermediate temperatures (~300 ^oC). The limited supply of stored NH_3 for the oxidation reactions lowers the negative effect of NH_3 oxidation at high temperatures. The fractional contribution of NH_3-oxidation reactions towards the consumption of NH_3 is calculated to be higher for the mixed configuration, which is further confirmed by the uniform axial profiles of stored NH_3 in the mixed configuration as compared to the dual-layer configuration. This results in a more prominent decrease in NO_x conversion for the mixed configuration as compared to the dual-layer configuration. The formation of NO_x at high temperatures by the oxidation of NH_3 in the combined configurations can result in a NO_x conversion even lower than the standalone LNT catalyst. A higher NH_3 slip is predicted for the mixed configuration as compared to the dual-layer configuration. It is highlighted that the composition of the LNT catalyst, its activity for NH_3-oxidation and the selectivity of products