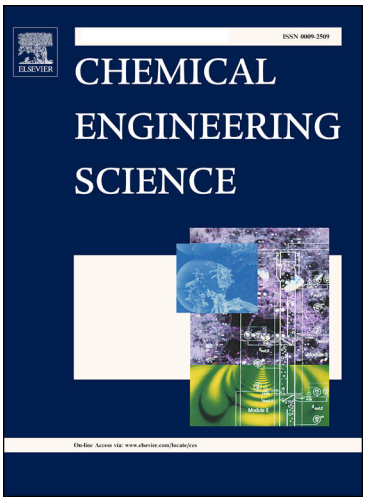

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Simulation of diesel exhaust aftertreatment system DOC—pipe—SCR: The effects of Pt loading, PtO_x formation and pipe configuration on the $deNO_x$ performance

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Abstract

A combined exhaust aftertreatment system consisting of a diesel oxidation catalyst (DOC), pipe and selective catalytic reduction of nitrogen oxides (SCR) is studied in this paper by the means of mathematical modeling and simulations. $Pt/\gamma\text{-}Al_2O_3$ DOC and $V_2O_5\text{-}WO_3/TiO_2$ SCR catalysts for heavy-duty Diesel engines are examined. First, spatially 1D models of the DOC, SCR and pipe are introduced and calibrated using the measured engine test data. The models are then employed in a simulation study of the effects of Pt loading, PtO_x formation and pipe configuration on the NO_2 yield in DOC and the resulting $deNO_x$ performance of the SCR in the driving cycles ETC and WHTC. It is shown that there exists optimum washcoat loading in the DOC with respect to NO_x conversion in SCR and that the minimization of heat losses in the connecting pipe can further improve the NO_x conversion. Finally, the decrease of NO oxidation activity in DOC due to PtO_x formation and its impact on NO_x conversion in SCR is quantified over the repeated driving cycles, showing 2–10 % difference between the $deNO_x$ performance with the pre-reduced DOC and after few hours of operation under oxidizing conditions. Based on the simulation results, an im-

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