

A Multi-dimensional Model for DEF Injection and Urea Decomposition in Mobile SCR DeNOx-Systems

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Selective catalytic reduction (SCR) of oxides of nitrogen with gaseous ammonia is a key technology that is being favored to meet stringent on-highway emission standards across the world. In this technology, a liquid mixture of urea and water - known as Diesel Exhaust Fluid (DEF) - is injected into hot exhaust gases leading to atomization and subsequent processes that ultimately generate gaseous ammonia. Due to the increasing interest in SCR technology, it is desirable to have capabilities to model these processes as accurately as possible to both improve the understanding of processes of fundamental importance to the aftertreatment system and to aid in system optimization. In the present study, a multi-dimensional model is developed to simulate DEF spray processes and the conversion of urea to ammonia. DEF particles are tracked in the Lagrangian framework and water evaporation and urea thermolysis are modeled using relevant heat and mass transfer laws. In addition, hydrolysis of iso-cyanic acid is modeled as a single step homogenous chemical reaction. The model is validated with experimental data available in literature and then applied to typical aftertreatment configurations that use flow dispersion devices and substrates. The results are discussed and some useful conclusions on aftertreatment system performance are drawn.

A brief bio is given below.:

Dr. Achuth Munnannur is a Senior Research and Development Engineer at Cummins Emission Solutions. His primary responsibilities include developing and validating exhaust aftertreatment models to support engine and aftertreatment system research and product development activities, and performing CFD modeling of complex physical and chemical processes. He holds a Ph.D. in Mechanical Engineering from the University of Wisconsin-Madison.

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