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Numerical Study on the Urea Melting and Induced Natural Convection in a Urea Sender Module

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Abstract : The Urea-Selective Catalytic Reduction (SCR) system is considered to be the most promising technology to fulfill the stringent emission regulation. In the Urea-SCR system, the urea solutions are used as the reducing agent, which is a eutectic composition (32.5wt% of urea). The advantage of this eutectic compositions is that it has a low freezing point approximately at -11 ℃, however, the problem of freezing occurs at low-temperature levels below that freezing point. To prevent freezing of urea solutions, we need heating systems that can melt by heating the frozen urea solutions in urea storage tank at low-temperature environment. In this study, therefore, a numerical investigation of three-dimensional unsteady heating problems analyzed to find the melting characteristics of the urea solutions on melting process. In this work, it can be found that the urea melting initiated by heat conduction from the heater is enhanced by the natural convection inside the melted liquid urea solutions due to the temperature difference. Also, liquid urea solutions are initially concentrated on the upper parts of the urea sender module.

Keywords : urea solution, melting, heat conduction, natural convection, liquid fraction, phase change
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