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Prediction of nucleation and coagulationmodes in the formation of Diesel particulate matter

The objective of this study was to develop a physical model to accurately predict the nucleation, coagulation, and dynamics of particulate matter emission from diesel-fueled engines. The model developed in this study does not require *a priori* any particulate matter (PM) size distribution data to solve the nucleation/coagulation equations; instead the PM concentration is predicted based on the fuel sulfur content, fuel to air ratio, exhaust flow rate, and the ambient conditions. This paper will discuss the computational fluid dynamics modeling of an exhaust plume dispersed from the exhaust stack of a tractor truck powered by a 330 hp (246 kW) diesel engine. This effort used the k-ε eddy dissipation model to accurately predict the variation of carbon dioxide concentration coming out of the stack into the ambient air. A specific goal of this effort was to study the effect of the recirculation region near the truck walls on dispersion of CO2 concentration. The predicted results showed an excellent agreement with the experimentally measured values of CO2 concentration variation, dilution ratio, and the temperature variations in the wind tunnel.

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