MULTIPHASE RADIATIVE HEAT TRANSFER CALCULATIONS IN HIGH-PRESSURE SPRAY COMBUSTION SIMULATIONS

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ABSTRACT. In this work, we study the importance of radiation in multiphase spray combustion in a high-pressure, engine-like configuration, and what level of fidelity for radiation modeling is appropriate. A multiphase photon Monte Carlo solver and a multiphase spherical harmonics solver are used for radiation modeling. Spectral properties of the participating media are treated as nongray. A series of fully coupled unsteady simulations are performed for a laboratory-scale engine configuration with different radiation solvers and spectral models. Results are compared with optically thin and spectrally gray approximations for participating media. Although radiation was found to have an insignificant effect on the evolution of the liquid spray, its effect on temperature distribution was found to be nonnegligible.