Abstract Submitted
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Enthalpy Diffusion in Multicomponent Flows[1] ANDREW COOK, LLNL — The enthalpy diffusion flux in the multicomponent energy equation is a well known yet frequently neglected term. It accounts for energy changes associated with compositional changes resulting from species diffusion. The term prevents local violations of the entropy condition in flows where significant mixing occurs between species of dissimilar molecular weight. In simulations of nonpremixed combustion, omission of the enthalpy flux can lead to anomalous temperature gradients, which may cause mixing regions to exceed ignition conditions. The term can also play a role in generating acoustic noise in turbulent mixing layers. Euler solvers that rely on numerical diffusion to blend fluids at the grid scale cannot reliably predict temperatures in mixing regions. On the other hand, Navier-Stokes solvers that incorporate enthalpy diffusion can provide much more accurate results. In constructing turbulence closures for high Reynolds number mixing, the same turbulent diffusion model that appears in the species mass transport equation should also appear in the energy equation as part of a "turbulent enthalpy diffusion"; otherwise the energy and species transport equations will not be consistent.

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