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Transport by molecular diffusion in LES of a turbulent diffusion flame KONSTANTIN KEMENOV, SHARADHA VISWANATHAN, HAIFENG WANG, STEPHEN POPE, Cornell University — Molecular diffusion effects in LES of a piloted methane-air (Sandia D) flame are investigated on a series of grids with progressively increased resolution towards the DNS limit. The role of molecular diffusivity in effecting spatial transport is studied by drawing a comparison with the turbulent diffusivity and analyzing their statistics conditioned on temperature. Statistical results demonstrate that the molecular diffusivity in the near-field almost always exceeds the turbulent diffusivity, except at low temperatures (less than 500K). Thus, by altering the jet near-field, molecular transport plays an important role in the further downstream jet development. Molecular diffusivity continues to dominate in the centerline region throughout the flow field. Overall, the results suggest the strong necessity to represent molecular transport accurately in LES studies of turbulent reacting flows.

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