DNS investigation of differential-diffusion effects on temporarily evolving turbulent diffusion flames\textsuperscript{1} ANTONIO ALMAGRO, MANUEL GARCIA-VILLALBA, OSCAR FLORES, Universidad Carlos III de Madrid, ANTONIO L SANCHEZ, University of California San Diego — The peak temperature of nonpremixed flames is known to have a profound effect on kinetically controlled processes with a strong temperature dependence, such as strain-induced extinction and NOx production. Here, the influence of differential diffusion on the flame temperature in diffusion-controlled combustion is investigated by direct numerical simulations of a turbulent diffusion flame in a temporarily evolving mixing layer for non-unity Lewis numbers of the fuel. The problem is formulated in the limit of infinitely fast combustion in terms of Shvab-Zeldovich conserved scalars, not changed directly by the reactions, obtained through chemistry-free linear combinations of the temperature and reactant mass fractions. A previously developed low-Mach-number code is used in the numerical integrations, which consider values of the thermochemical parameters – characterizing the exothermicity and stoichiometry of diffusion-controlled combustion – and fuel Lewis number typical of hydrogen-air and hydrocarbon-air flames. The results of the simulations are used to assess the effect of turbulence and fuel diffusivity on the flame response.

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