Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

DNS investigation of differential-diffusion effects on temporarily evolving turbulent diffusion flames[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 asses the effect of turbulence and fuel diffusivity on the flame response.

[1]This work was funded by the Spanish MCININ under project CSD2010-00011. The computational resources were provided by the XSEDE program, supported by NSF grant number ACI-1053575.

Oscar Flores
Universidad Carlos III de Madrid

Date submitted: 30 Jul 2016 Electronic form version 1.4