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DNS of turbulent premixed slot flames with mixture inhomogeneity: a study of NO_x formation STEFANO LUCA, KAUST, Saudi Arabia, ANTONIO ATTILI, RWTH, Aachen University, Germany, FABRIZIO BISETTI, University of Texas at Austin, USA — A set of Direct Numerical Simulations of three-dimensional methane/air lean flames in a spatially developing turbulent slot burner are performed. The flames are in the thin-reaction zone regimes and the jet Reynolds number is 5600. This configuration is of interest since it displays turbulent production by mean shear as in real devices. The gas phase hydrodynamics are modeled with the reactive, unsteady Navier-Stokes equations in the low Mach number limit. Combustion is treated with finite-rate chemistry. The jet is characterized by a non-uniform equivalence ratio at the inlet and varying levels of incomplete premixing for the methane/air mixture are considered. The global equivalence ratio is 0.7 and temperature is 800 K. All simulations are performed at 4 atm. The instantaneous profiles of the mass fractions of methane and air at the inlet are sampled from a set of turbulent channel simulations that provide realistic, fully turbulent fields. The data are analyzed to study the influence of partial premixing on the flame structure. Particular focus is devoted to the assessment of heat release rate fluctuations and NO_x formation. In particular, the effects of partial premixing on the production rates for the various pathways to NO_x formation are investigated.

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