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Simulation of the effects of sub-breakdown electric fields on the chemical kinetics in nonpremixed counterflow methane/air flames MEMDOUH BELHI, HONG IM, King Abdullah University of Science and Technology, COMPUTATIONAL REACTING FLOWS LABORATORY, CLEAN COMBUSTION RESEARCH CENTER TEAM — The effects of an electric field on the combustion kinetics in nonpremixed counterflow methane/air flames were investigated via one-dimensional numerical simulations. A classical fluid model coupling Poisons equation with transport equations for combustion species and electric field-induced particles was used. A methane-air reaction mechanism accounting for the natural ionization in flames was combined with a set of reactions that describe the formation of active particles induced by the electric field. Kinetic parameters for electron-impact reactions and transport coefficients of electrons were modeled as functions of reduced electric field via solutions to the Boltzmann kinetic equation using the BOLSIG code. Mobility of ions was computed based on the (n,6,4) and coulomb interaction potentials, while the diffusion coefficient was approximated from the mobility using Einstein relation. Contributions of electron dissociation, excitation and ionization processes were characterized quantitatively. An analysis to identify the plasma regime where the electric field can alter the combustion kinetic was proposed.

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