An experimental and kinetic modeling study of premixed nitroethane flames at low pressure

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An experimental and kinetic modeling study is reported on three premixed nitroethane/oxygen/argon flames at low pressure (4.655 kPa) with the equivalence ratios (Φ) of 1.0, 1.5 and 2.0. Over 30 flame species were identified with tunable synchrotron vacuum ultraviolet photoionization mass spectrometry, with their mole fractions quantified as the function of the height above burner. The flame temperature profiles were measured with a Pt-6%Rh/Pt-30%Rh thermocouple. A detailed kinetic mechanism with 115 species and 730 reactions was proposed and validated against experimental results. The computed predictions have shown satisfactory agreement with the experimental results. Basing on the rate-of-production analysis, the reaction pathways that feature the combustion of nitroethane were revealed, including the primary decomposition of C–N bond fission, the oxidation of C2 and C1 hydrocarbons and the formation of nitrogenous species. The presence of NO2 and NO has been proved to be important for these processes.

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