Shock-induced ignition of ammonia doped with promoting admixtures

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Ammonia NH_3 is considered a promising hydrogen carrier. Its poor qualities as a pure fuel make it necessary to use various additives as combustion promoters, particularly biofuels whose use is necessary to achieve carbon neutrality. Several detailed kinetic models of ammonia combustion in the presence of hydrocarbons and oxygenates have been developed recently [1], and their validation with experimental data remains an important task.

Shock-wave induced ignition of ammonia doped with simplest hydrocarbons CH_4, C_2H_2, C_2H_4 and C_2H_6, as well as oxygenates CH_3OH and CH_3OCH_3, was studied experimentally and temperature dependencies of ignition delay times were obtained in range of temperatures 1250–1950 K and pressures 3.5–13.5 bar. Ignition was observed behind the reflected shock waves in a shock tube of a standard design by registration of OH radical emission. All studied argon-diluted combustible mixtures contained 7 mol. % oxygen and were stoichiometric.

Kinetic modeling was performed in Cantera [2] using kinetic mechanisms of interest. Dependencies of induction times on temperature, pressure and mixture composition were obtained and compared with experimental results. A sensitivity analysis of induction times to rate constants of individual reactions was carried out and indicated a notable role of underinvestigated reactions involving N_2H_n species.

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[1] Elbaz A M, Wang S, Guiberti T F and Roberts W L 2022 *Fuel Communications* **10** 100053

[2] Goodwin D, Moffat H, Schoegl I, Speth R and Weber B 2023 Cantera: An object-oriented software toolkit for chemical kinetics, thermodynamics, and transport processes Report