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Explosion of LPG-air Mixtures in a Spherical Vessel in the Presence of Hydrogen

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Extended Abstract

The hydrogen-hydrocarbon mixtures have attracted more and more attention in the last decades. Recent studies showed that hydrogen addition to various fuels could increase engine thermal efficiency and improve the lean burn capability of the fuel [1-3]. The increase of the oxidation rate might determine also the decrease of the quenching distance and minimum ignition energy, the increase of the normal burning velocity and of the propagation speed, without major changes of the peak explosion pressure and flame temperature [4-6].

The present paper reports data from an experimental study on pressure evolution during closed vessel explosions of gaseous mixtures, at various initial pressures within 0.3 – 1.0 bar and ambient initial temperature. Explosion pressures, maximum rates of pressure rise and explosion times of stoichiometric hydrogen/LPG/air mixtures with various hydrogen/LPG ratios were measured in a spherical vessel (Φ = 10 cm). The deflagration index of centrally ignited explosions was also calculated from maximum rates of pressure rise. It was found that both the explosion pressures and the maximum rates of pressure rise are linear functions on total initial pressure, at constant initial temperature and fuel concentration. The measured explosion pressures are examined in comparison with the adiabatic explosion pressures, computed by assuming chemical equilibrium within the flame front. The influence of initial pressure and composition on explosion pressures, maximum rates of pressure rise and explosion times are discussed for the examined systems.

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