DETONABILITY OF AIR MIXTURES OF THE POLYPROPYLENE PYROLYSIS PRODUCTS

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Abstract: For the first time, the possibility of using the products of gasification/pyrolysis of solid combustible in advanced ramjet engines operating on detonation combustion was considered. A new method for determining the detonability of a fuel is proposed, that is, on the basis of measured values of the detonation run-up distance and/or time in the standard pulse detonation tube. Granular polypropylene is selected as a solid fuel. A gas generator was designed, manufactured, and tested to obtain polypropylene pyrolysis products at a decomposition temperature of 650 to 800 °C. Chromatographic analysis of the products showed that they mainly consist of propylene C_3H_6, isobutene iso-C_4H_8, ethane C_2H_6, methane CH_4, ethylene C_2H_4, and propane C_3H_8. Experiments on the study of deflagration-to-detonation transition in air mixtures of hot polypropylene pyrolysis products were carried out. It is shown that in mixtures with air, somewhat enriched in fuel (with an air-to-fuel equivalence ratio of $0.73 \leq \alpha \leq 0.90$), at normal pressure and elevated initial temperature (60–90 °), the pyrolysis products of polypropylene have a detonability close to the detonability of liquefied petroleum gas of the PBA brand — propane–butane automobile — in a stoichiometric mixture with air under normal conditions.

Keywords: detonability; standard pulse-detonation tube; granulated polypropylene; pyrolysis products; fuel–air mixture; deflagration-to-detonation transition

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