Experimental investigation of detonation in fuel rich acetylene-oxygen mixtures

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Acetylene is unique hydrocarbon capable of oxygen-free detonation due to significant amount of heat release in its pyrolysis. Based on this fact the new energy cycle was considered [1]. In this work, the formation of detonation wave in the mixtures of acetylene with variable oxygen additions diluted in argon was studied. The content of argon was constant for all mixtures and amounted 70%. The concentration of oxygen was varied from 21.5% corresponding to stoichiometric mixture to 1%. The mixture of 30% of acetylene in argon without oxygen addition was also studied. The experiments were carried out at shock tube facility behind incident shock waves. Eight piezoelectrical pressure transducers located at distances from 35 to 105 caliber of driven section of shock tube were used to register shock and detonation waves propulsion. The detonation mode was registered in all considered mixtures. The experimentally observed stationary detonation velocity was equal to calculated by Chapman-Jouguet theory for mixtures with large amount of oxygen where equilibrium state of products could be reliably described by modern thermodynamic data. Kinetic calculations of heat release due to carbon condensation during acetylene decomposition are discussed.
This work was supported by the RSF grant 21-19-00390.

[1] Fortov V *et al* 2021 *Russ. J. Phys. Chem. B* **15** 299