SIMULATION OF HOMOGENEOUS HYDROGEN–AIR DETONATION INTERACTION WITH POROUS FILTER*

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Abstract: Calculations of the interaction of a cellular detonation wave (DW) with an inert porous filter were carried out based on the developed physical and mathematical model of the mechanics of heterogeneous medium which takes into account the detailed chemical kinetics of chemical reactions in the gas phase. Under an inert porous filter, a motionless lattice of inert particles is considered. The following flow regimes were revealed: propagation of attenuated cellular DW at velocities less than the Chapman–Jouguet velocity and detonation failure with the destruction of the cellular structure. Critical volume concentrations of filter particles corresponding to the detonation failure regime were calculated. Dependences of the normalized DW velocity and detonation cell size on the volume concentration of particles in filters were calculated. The concentration limits of detonation (critical volume concentrations of particles lead to detonation failure) in filters with diameters of 50, 100, and 200 μm were determined. The dependences of the normalized DW velocity and size of detonation cell on the volume concentration and diameter of particles in filters were calculated.

Keywords: physical and mathematical modeling; homogeneous detonation; inert porous filter; detonation failure

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