Effect of single particle diameter on initiation of shock gas detonation

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In the present work a numerical study of the effect of a diameter of a single solid sphere particle on the shock detonation initiation in a combustible mixture has been carried out. The disturbance wave reflected from the walls of the tube returns behind the particle to the center of the tube at a distance of the order of the tube radius. In order to avoid the influence of the reflected wave on the flow parameters in front of the particle, the radius of the tube was set much larger then the particle radius. Calculations were performed in the range of applicability of the model approximations, namely, for post-shock intervals not exceeding temperature and velocity relaxation times. The velocity relaxation time is taken to be the time during which the particle velocity increases $e = 2.718$ times. The comparison of calculations is convenient to carry out on the fluid patterns. For example temperature fluid patterns for three different particle diameters are presented in this work for different post-shock intervals. In our calculations with the smallest diameter of 80 μm detonation was not initiated, since with this size of the particle, energy release on it is not enough to initiate detonation. For the other two diameters 160 and 320 μm, the fluid temperature and other thermodynamic values in the vicinity of the particles are similar. It has been noted that in the studied range of diameters, the ignition times have not been changed by the increase of particle diameter. The induction time is taken to be the time of the temperature increase by 5% due to chemical reactions.