THE ENERGY DISTRIBUTION IN THE OVERDRIVEN DETONATION AND IN SHOCK WAVES AND ITS INFLUENCE ON THEIR STABILITY

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On the basis of exact thermodynamic computations of the shock and equilibrium adiabat (Hugoniot curves) for overdriven detonation waves, the value of overdriving (velocity) was established, under which the chemical reaction heat release ΔH_x^0 changes its sing with transition to equilibrium as a result of augmentation of reaction product dissociation. If overdriving is more, the character of flow becomes alternate depending on whether the reaction product molecular mass increases (mixture of type "A") or decreases (mixture of type "B") in the Chapman-Jouguet regime in comparison with the initial state.

In the case "A", as usual, the shock and equilibrium adiabats (Hugoniots) intersect in close proximity to the point where $\Delta H_x^0=0$. In the case "B", in a certain range of velocities, an anomalous behavior of pressure is observed behind shock wave: in spite of reaction endothermicity, pressure decreases, and adiabats intersection takes place when the overdriving becomes rather more intensive.

The conservation of a cellular structure in the mixtures of type "B" and the anomalous pressure behavior at $\Delta H_x^0 \leq 0$ are explained by the energy release of intramolecular freedom degrees in the progress of the chemical reaction.

The instability of flow observed sometimes in shock waves has the similar nature – a liberation of the energy accumulated during shock transition on intramolecular freedom degrees, but, in view of the absence of chemical reactions, it is necessary to take into account a difference in relaxation times between translation and intermolecular freedom degrees. Non-equilibrium phenomena within shock transition leading to local over of translation temperature in comparison with its value behind the shock wave can simulate energy accumulation on high quantum levels.