Determination of detonation initiation threshold in emulsion explosives at different concentrations of microspheres

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The object of the study in the work is a reverse emulsion based on an aqueous solution of ammonium nitrate with different concentrations of hollow glass microspheres. The average diameter of the microspheres is 70 μm. The authors studied three types of emulsion matrix samples featuring various filler concentrations, the latter being 1, 3 or 4% by mass. The mass velocity profiles were recorded with VISAR laser Doppler interferometer.

The initiation thresholds for all the studied compositions under shock-wave loading were determined.

At pressures above the reaction initiation threshold, the evolution of the wave profiles as they propagated through the sample was recorded. This made it possible to determine the distance to the steady-state detonation regime depending on the amplitude of the incoming wave. For example, for a composition with 1% microspheres, the steady-state detonation regime is established at a sample thickness of 15 mm at a pressure of 3.82 GPa. Increasing the microsphere concentration to 3% increases the sensitivity of the emulsion explosive, which leads to the establishment of a steady-state regime at the same sample thickness at a lower pressure of 1.34 GPa.

The structure of the wave profiles corresponds to the classical detonation wave ZND with a characteristic time in the reaction zone not exceeding 1 μs.

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