Microballoon and Amine Sensitization of Nitromethane Detonation

Mochalova V.M.[1,@], **Utkin A.V.**[1], **Shakula M.Yu.**[1,2], **Sosikov V.A.**[1], **Torunov S.I.**[1], **Rapota D.Yu.**[1], **Lavrov V.V.**[1] **and Savchenko A.V.**[1]

[1] Federal Research Center of Problems of Chemical Physics and Medicinal Chemistry RAS, Ac. Semenov avenue 1, Chernogolovka, 142432, Russian Federation

[2] Moscow Institute of Physics and Technology, Institutskiy Pereulok 9, Dolgoprudny, 141701, Russia

[@] roxete20000@mail.ru

Nitromethane (NM) is a widely studied liquid explosive whose detonation properties can be modified using additives. Chemical sensitizers like amines or mechanical impurities such as hollow microballoons significantly alter critical detonation conditions, reaction kinetics, and shock sensitivity. Mechanical additives create hot spots, modifying reaction macrokinetics. This work investigates the combined effect of a chemical sensitizer, diethylenetriamine (DETA), and a mechanical one, glass microballoons, on detonation of NM. The structure of detonation waves was recorded with a laser interferometer, and initiation was studied via high-speed camera. The most pronounced effect of DETA occurs at low microballoon concentrations (≤ 5 $wt.\%$). Adding 2% DETA to such a mixture halves the critical detonation diameter. However, effectiveness of DETA diminishes when microballoon content exceeds 8%. High-speed camera captured the dynamics of hot spot initiation and their growth in the heterogeneous explosive. The study demonstrates the promise of combining amines and microballoons to control the detonation parameters and critical diameter of NM over a wide range.

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