Experimental investigation of the instability of detonation waves in liquid high explosive

Sosikov V A®, Torunov S I, Utkin A V, Mochalova V M and Rapota D Yu

Institute of Problems of Chemical Physics of the Russian Academy of Sciences, Academician Semenov Avenue 1, Chernogolovka, Moscow Region 142432, Russia

® vaso@yandex.ru

Experimental investigation of unstable detonation front structure in mixtures of liquid high explosives (bis-(2-fluor-2.2-dinitroethyl)-formal (FEFO) and nitromethane) with inert diluents (acetone, methanol, diethylene triamine (DETA)) has been carried out. Inhomogeneities have been registered by electro-optical camera NANO-GATE 4BP allowing to make 4 frames with the exposure time 10 ns. According to experimental results the detonation front in nitromethane-acetone mixture is unstable. It is evident that pulsations on detonation front do not form spatial periodic structure and their dimensions differ several times. But mean longitudinal size of pulsation is about 500 µm at 20% of acetone concentration. This means that the typical size of cell equals to reaction zone width. The same structure of cellular front have been registered in 70/30 FEFO-methanol mixture. Second kind of instability, failure waves, was observed in neat nitromethane at the free surface. In this case the stability loss result in turbulent flow which is clearly detected in the shots obtained. Adding small amount of DETA (0.5%) results in disappearance of the failure waves and flow stabilization. The effect is caused by the fact that DETA sharply accelerates initial rate of chemical reaction because it is sensitizer for nitromethane. The research has executed for the project Russian Foundation for Basic Research No. 15-03-07830.