

Prevention of self-ignition of a flammable gas mixture using a destructible granular screen

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One of the current problem of explosion safety is to reduce the consequences of the explosion of gas mixtures. During shock wave compression of a combustible mixture with its subsequent ignition, the use of a destructible screen is one of the most significant ways to weaken the intensity of the shock wave [1–3]. The purpose of this work was to consider the possibility of using a destructible screen in order to prevent self-ignition in a flammable hydrogen–air mixture behind the reflected shock wave.

The experiments were carried out using a shock tube. The destructible screen was made of quartz sand with a small amount of binder—blue clay or cement. Incident, reflected and transmitted shock waves at an initial pressure of 0.02 MPa were analysed. The ignition was recorded using a photomultiplier tube. The dynamics of the destroyed screen were recorded by a high-speed digital camera. It was shown that the use of the screen can prevent the ignition of a hydrogen-air mixture (14% vol.) in a narrow range of Mach numbers M_1 from 2.29 to 2.30. At greater Mach numbers M_1 heating of the mixture behind the reflected shock wave leads to ignition when the screen is destroyed.

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