P71 Shock and Blast Mitigation by Dry Aqueous Foams

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Abstract:

The aqueous foams are often used to mitigate the blast wave issued from explosions. This paper presents results of experiments and numerical modeling on the mitigation of shock and blast waves by using dry aqueous foams.

Experiments of shock wave propagation in aqueous foams (IUSTI shock tube) have been carried out by Jourdan et al. (2012) and the foam mitigation has been investigated. The high pressure (HP) chamber is filled with SF6, air or helium. The low pressure (LP) chamber is separated in two parts. The first one immediately after the diaphragm separating the HP and the LP chamber allows the formation of an incident shock wave and its measurement. The second part is a test section filled with foam of different expansion ratios (ER). In first approximation, ER corresponds to the inverse of the volume fraction α_L of the liquid. Two pressure transducers in air and six in the foam are used to register the pressure histories. The experiments conducted in the Jourdan et al. (2012) campaign concern foam of ER 30 or 80 and shock wave Mach numbers of 1.3, 1.5 and 1.8.

Experiments of blast wave propagation (explosive detonation) in aqueous foams have been carried out by Del Prete et al. (2012) at PEM (Polygone d'Expérimentation de Moronvilliers - CEA/DAM). They have been performed in order to investigate the influence of the physical properties of aqueous foam, such as the liquid volume fraction, the bubble size and the viscosity of the surfactant on their mitigation properties. About 145 g of high explosive (HE) has been detonated in a cylindrical enclosure filled with aqueous foam. Side-on overpressure transducers are placed at various distances from the charge on 3 beams. The experiments conducted in the campaign concern foam of ER 30, 60 and 120.

The multiphase formalism is used to model the interactions of the liquid phase with the gaseous phase, as well as the interaction of the high explosive with the two-phase medium. Attenuation is explored through peak overpressures and positive impulses. It is found that the attenuation depends mainly on the overall liquid content, i.e. the expansion ratio is the most significant parameter. The smaller it is, the more effective will be the attenuation.

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