CAPTURE OF PARTICLES DISPERSED BY DETONATION USING AN AQUEOUS FOAM CONFINEMENT

M .Mikart[1,2], D. Counilh[1], F. Gensdarmes[3], A. Chinnayya[2]

[1]CEA, DAM, Ile-de-France, Arpajon, 91297, France
[2]Institut PPrime, UPR CNRS 3346, ENSMA, BP 40109, Futuroscope-Chasseneuil Cedex, 86962, France
[3]IRSN, Gif-sur-Yvette Cedex, 91192, France

Key words : Capture - Confinement - Foam – Particles - Multiphase fluid flow

Over the past decades, the needs to mitigate detonation effects have significantly increased. To deal with these issues, the French Nuclear Energy Agency has studied aqueous foam confinement. This solution has two advantages. Firstly, the presence of these two-phases medium leads to drastically attenuate the blast wave generated by the detonation of an explosive device. Secondly, the presence of the liquid phase slows down and ultimately captures the micrometric and potentially harmful particles dispersed by the explosion. This specific topic will be discussed in this paper.

Over the last year, we have conducted an experimental campaign which dealt with the potential of an aqueous foam confinement to capture micrometric particles. For this purpose, two configurations were tested: 88 g of micrometric tungsten powder for a 44 g explosive charge and 300 g of micrometric tungsten powder for a 150 g explosive charge. In the two cases, the tungsten powder has been dispersed in the air by the explosive charge. Two tungsten powder mean diameters were used, 1 and 4 µm, and confinements of various sizes were placed over the particles in order to quantify the ability of the foam to capture them. After the charge detonation, the airborne particles were sampled and both the concentration of this airborne aerosol and the particles size were monitored.

The results obtained from the different configurations were compared in order to quantify the capture ratio depending on the size of the confinements, the particle size and the mass of explosive charge. They confirm the foam's efficiency in capturing particles. However, an observation of the velocity and particles dispersion reveals that this efficiency is not linearly dependent on the foam's length.