PROTECTION EFFECTIVENESS OF CALCIUM-SILICATE BASED-MINERAL FOAM FOR BLAST MITIGATION

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Abstract: Cellular materials, such as aluminum foam, have proven to be highly effective at absorbing energy, making them ideal for use as crushable cores in sacrificial cladding for blast mitigation. This paper presents insights into the blast response of a brittle mineral foam-based sacrificial cladding. The experimental set-up used involves a rigid steel frame (1000 mm × 1000 mm × 15 mm) with a square cavity of 300 mm x 300 mm at its center. A 2mm-thick aluminum plate, representing the structure to be protected, is clamped into the frame, which is then subjected to a blast load generated by detonating 20 g of C4 placed at a distance of 250 mm from the center of the plate. Two synchronized high-speed cameras in a stereoscopic configuration are used to capture the dynamic response of the aluminum plate at a frame rate of 20000 frames per second. The absorption capacity of the brittle mineral foam is assessed by comparing the out-of-plane displacement, the velocity and the acceleration of the thin aluminum plate with and without the protective mineral foam. Two foam configurations with different thicknesses are considered: 60 mm and 120 mm. It is shown that adding the brittle mineral foam reduces the out-of-plane displacement together with the displacement velocity and acceleration of the aluminum plate at least by a factor of two.