BLAST PERFORMANCE OF LOW-DENSITY FOAM WRAPPED ALUMINUM TUBES

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Abstract: This study aims to explore the efficiency of a sacrificial cladding composed of a low-density foam and an outer lightweight skin wrapped around a studied structure. The latter is a simply-supported 6060-T66 aluminum tube subjected to a shock-tube-generated blast wave. The selected solution comprises open-cell polyurethane foam (PU) having a density of 30 kg/m^3 and a 1mm aluminum sheet of commercial code EN-AW-1050A-H24. The bare specimens having dimensions of 1200mm x 100mm x 2mm are cut from 6m-long aluminum tubes. First, quasi-static experiments are conducted on the chosen materials to determine their mechanical properties. Second, a set of experimental results using the Explosive shock-driven shock tube (EDST) are analyzed with respect to the repeatability, and planarity. A finite element model using physics-based LS-DYNA software is developed and validated to explore the spatial and temporal distribution of the reflected pressures and impulses around a circular aluminum tube. The global response of the bare and retrofitted chosen tubes is recorded using a high-speed 3D digital image correlation technique. Using reverse engineering, the local deformation represented by the mid-span indentation is quantified. Besides, the influence of the proposed solution on global and local deformations of the retrofitted tube is investigated. The maximum peak displacement for the retrofitted tubes is reduced by 49% and 72% compared to their bare counterparts when using 50mm and 100mm of PU foam, respectively.