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BLAST WAVE MITIGATION USING MULTI-PHASE SOLID MATERIAL IN A SANDWICH CLADDING

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ISL has been working on blast effects mitigation for more than 15 years. Targets with different characteristic dimensions, from the unprotected soldier to the steel-reinforced concrete bunker, are being exposed to blast waves generated by high explosive detonation. One of the mitigation method studied in ISL consists in protecting the target from the explosion with a sandwiched crushable core between a front plate and the target. This blast mitigation method is well described in literature. The role of the front plate is to spread the blast load on the entire surface of the deformable material, assuming its rigidity is enough not to be deformed by the impacting shock. Therefore, the pressure generated by the explosion is converted into a planar displacement. The front plate compresses the crushable core and, in the best-case scenario, the crushable core absorbs the energy of the blast through elastic, plastic and brittle deformation.

In this study, a planar shock was generated with an explosive driven shock tube. Explosive charges (High Explosives, from 20 to 70g TNT eq.) were detonated in front of the EDST, generating a 40 to 150 bar overpressure at the end of the tube. A load sensor was put on the target, and a high-speed camera recorded the deformation of the crushable core. In addition to the experimental study, the compression of the crushable core was simulated using LS-DYNA. Numerical and experimental loading profiles are compared and analyzed to provide guidelines for protection methods development.