The dynamic response of a viscoelastic biological tissue simulant
CHRISTOPHER SHEPHERD, GARETH APPLEBY-THOMAS, PAUL HAZELL, DEREK ALLSOP, Cranfield University — The development and optimisation of new projectiles requires comparative techniques to assess ballistic performance. Porcine gelatin has found a substantial niche in the ballistics community as a tissue mimic. Primarily due to its elasticity, gelatin has been shown to deform in a similar manner to biological tissues. Bullet impacts typically occur in the 350-850 m/s range and consequently, knowledge of the high strain rate dynamic properties of both the projectile constituents and target materials is desirable if simulations are to allow the optimisation of projectile design. A large body of knowledge exists on the dynamic properties of projectiles, however relatively little data exists in the literature on the dynamic response of flesh simulants. The Hugoniot for a 20 wt% porcine gelatin, which exhibits a ballistic response similar to that of human tissues at room temperature, is determined in this paper using the plate impact technique. Up-Us and Up-P relationships are determined for impact velocities in the range of 200-900 m/s. Good agreement with the limited available data from the literature for similar concentrations is found and the dynamic response established at impact stresses up to 3 times higher than that observed elsewhere. Additionally, high frequency elastic properties are investigated using ultrasound and compared to those observed elsewhere.

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