EXPERIMENTAL INVESTIGATION OF THE PENETRATION AND PERFORATION OF BUILDING MATERIALS BY PROJECTILES

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Abstract

The penetration and perforation of aluminum and steel targets by high-strength projectiles, such as tungsten-alloy rods, have been investigated extensively in the past. Accordingly, a large amount of data exists, allowing for a detailed modeling of projectile effects against metallic semi-infinite and finite-thickness targets. Recently, however, the interest in characterizing the response of building materials toward projectile impact has increased. Building materials depict a class of materials which significantly differ from metallic materials. These materials are of relatively low density and strength. Furthermore, they are typically inhomogeneous and show scattering material properties. All this may lead to new and unexpected phenomena occurring upon projectile penetration.
An experimental investigation of the penetration of projectiles into building materials has been performed. As results for concrete, sand and a few other target materials are available in the literature, the present investigation focuses on targets consisting of adobe bricks. Other materials were considered for comparison. In the conducted ballistic experiments the residual projectile velocities behind a perforated target have been determined as a function of impact velocity for tungsten-alloy rod penetrators and spherical steel projectiles. For the spheres, additional depth-of-penetration tests have been performed. The actual target densities and strengths have been verified by material testing. We interpret the experimental ballistic results with the help of simple analytic plate-plugging models and force law approaches.

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