Thick AA7020-T651 plates under ballistic impact of fragment simulating projectiles

T. Fras[1)], L. Colard[1)], B. Reck[1)]

[1)] French-German Research Institute of Saint-Louis (ISL), 5 rue du General Cassagnou, 68301 Saint-Louis, France

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Understanding the interaction between a projectile and a ballistic protection structure is the first requirement for the design and optimization of an effective protection. Since the impact phenomenon involves highly dynamic and complex loadings of the structural components, the numerical simulation is necessary to complete impact experiments and to get an insight into the different mechanisms occurring during penetration and perforation processes.

The study addresses the ballistic performance of the Al alloy AA7020-T651 (AlZn4.5Mg1, 3.4335) against fragment simulating projectiles (FSP). Regarding the ratio of the specimen thickness to the projectile diameter, the target plates can be considered as thick. The failure occurring in plates consists of the plugging and discing modes, as a combination of shear and bending fracture modes, which are characteristic for anisotropic materials of rolled texture. In order to understand the mechanisms occurring in the material under highly dynamic loadings, its mechanical, thermal and micro-structural properties are investigated. The functions describing material are used to numerical prediction of the projectile - target response by means of the Ls-Dyna Lagrangrian approach. The experimental conditions (thick target, penetrator of a specific shape, high velocity impacts) allow us to draw conclusions, which are complementary to those resulted from investigations of semi-thick and thin target plates under ballistic impact in a lower range of initial velocity.

References:

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