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New Results on Ballistic Performance of Multi-Layered Metal Shields: Review

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Abstract
This survey includes, mainly, investigations that were published during recent years and a few earlier studies that were not included in the review by the same authors published in 2012. The survey covers analytical, numerical and experimental studies in which the effect of layering, spacing and change of the order of the plates on the protective performance of metallic shields against high-speed impact is investigated, and also studies that suggested analytical methods for optimization of multilayered shields.

Keywords: Layering, Spacing, Air Gap, Metal, Layered Shield, Layered Target

1. Introduction

The present survey includes analytical, numerical and experimental investigations which elucidate effect of layering, spacing and change of the order of the plates on the ballistic performance of metallic shields at high-speed impact, and studies dealing with analytical methods for optimization of multi-layered shields. The goal of the survey is to systemize these investigations, to familiarize experts with this topic and to facilitate search and processing of information. Important feature of this review is that it includes also studies with mutually contradictory conclusions that allows to avoid subjective selection of data for validating penetration models.

Many studies in this field were published after appearance of our previous review (see Ben-Dor *et al*. [1]). However reviews on protective properties of multi-layered shields either do not include metal shields or very briefly cover this topic (e.g. [2]). We also discovered that a certain number of earlier studies were not included in the review [1]. Consequently, a new review is needed that must be considered as an essential addition to the review [1]; together they provide a complete overview of the state-of-the-art in the field.

The notations used below in description of the structure of the shield are demonstrated by the examples in Table 1. Other notations are given in Table 2.

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