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STUDY ON THE MECHANISM OF KINETIC ENERGY DISSIPATION OF GRADED IMPEDANCE MATERIALS WITH HIGH EFFICIENCY

Abstract

Shield with graded-impedance material as bumper is obviously superior to the aluminum alloy shield with the equal areal density against the space debris. The experimental results show that the protective performance of the graded-impedance material as bumper is improved by more than 30% compared with that of aluminum alloy by reasonably designing the graded-impedance distribution function. The mechanism of high efficiency dissipation of kinetic energy for graded-impedance material is an important theoretical basis for understanding its impact resistance and further optimizing its design. In this paper, the graded-impedance material and the aluminum alloy are studied in three aspects: the law of shock wave propagation in projectile and bumper, the law of projectile breaking during the interaction of projectile and bumper, the law of initial shock energy dissipation in the process of projectile and bumper interaction. The results show that, compared with homogeneous aluminum alloy material, the graded-impedance material with the equal areal density has many outstanding advantages, such as long shock wave propagation time, strong ability to crush projectiles and excellent ability to dissipate shock wave energy. These prominent characteristics are the reason why the graded-impedance material has the ability to dissipate kinetic energy efficiently.