LIGHT METAL-CERAMIC PASSIVE ARMOUR FOR SPECIAL APPLICATION

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Abstract

The article presents results of firing tests of panels including layers of various thickness: ceramic tiles (Al₂O₃, SiC, B₄C, AlN), metallic (aluminium, RHA), polyethylene, laminates reinforced by epoxy resin fibres or aramid fabric. The firing tests were also applied to the panels of a new type of tiles sintered from materials based on inter-metallic NiAl phases, obtained in high-temperature exothermic synthesis of powders. These panels contained single tiles, ceramic and NiAl-based, of 50x50 mm size and different thickness, or large number of ceramic tiles made by gravity die casting.

Additionally, there have been submitted results of tests of panels obtained by joining individual layers with glue and laminating with epoxy resins, chemically or thermally cured. The said panels were designed as elements of passive spatial armours, not touching directly protected surface of the object.

All tests aimed to develop a design and technology of production of passive armours having minimum weight and thickness, at protection level 2 according to STANAG 4569. The discussed here tested layers are purposed for use in various additional passive armours, protecting against puncture with the 7.62 mm and 12.7 mm armour-piercing projectiles of B-32 type both the unarmoured objects (helicopters, etc.) and the armoured ones (light combat vehicles, recognition and support vehicles, special purpose vehicles and civilian vehicles for transport of VIPs and valuable cargos).

For all types of the ceramic materials fired with the 12.7 mm projectiles of B-32 type an effective stopping was obtained for the metal-ceramic panels made by gravity die cast of aluminium alloys and the ceramic tiles of 50x50mm size and 8÷12 mm thickness. The highest protective ability against firing by these projectiles was achieved for models of armours with NiAl10Ni and NiAl10NiSi tiles, embedded in an aluminium alloy matrix. After piercing of the tiles there were splinters of the projectile penetrating that panel, stuck in the rear part of it. Placing panels of this type directly on a plate of the light-armoured vehicle hull can protect it from piercing with the 12.7 mm armour-piercing projectiles of B-32 type.

The firing tests of models of passive spatial armours, obtained by gluing and laminating from Al₂O₃, SiC, B₄C ceramics, of 6÷10 mm thickness, showed effective stopping the 7.62 mm projectiles of B-32 type for panels of the following parameters: thickness ~ 20 mm, mass 44 kg/m² for Al₂O₃, 38 kg/m² for SiC and 32 kg/m² for B₄C.

The results of tests for the tiles of Al₂O₃, SiC, B₄C, AlN and NiAl, placed on the RHA plate, showed sufficient resistance to firing with the 7.62 mm and 12.7 mm armour-piercing projectiles of B-32 type. These tiles used in the spatial armours were also effective when firing with the 7.62 mm projectiles of B-32 type.