Nanostructured surfaces

The formation of shock-protective properties of the surfaces of aluminum alloys under the influence of intense relativistic electron beams

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Development of shock protective surfaces is one of the key tasks for providing safety of people and technical systems. Among of the many existing approaches to the solution of this problem, we dwell on the surface hardening technology of metal plates by irradiation of intense relativistic electron beams.

We studied the changes in the physico-mechanical and structural properties of the alloys SAV-1 (0,012 Cu; 0,45 Mg; 0,012 Mn; 0,2 Fe; 0,7 Si; 0,03 Zn; 0,012 Ti; 0,03 Ni) and AMg6 (0,1 Cu; 6 Mg; 0,6 Mn; 0,4 Fe; 0,4 Si; 0,2 Zn; 0.1 Ti; 0,003 Be) under the influence of intense relativistic electron beams. It leads to an ultrafast heating of the material of sample concurrently with the occurrence of radiation and shock-wave activation processes affecting formation considerable concentrations of defects in the material leading to structural and phase changes. At the same time the depth of the modified layer is much higher than the mean path of electrons in the material.

Experimental studies were carried at the accelerator MIG-1 (at the NSC "KhPTI", Kharkov) with the following parameters: electron energy ~ 0.5 MeV beam current $\leq$ 5 kA, pulse duration up to 5 microseconds. The density of the energy released at the surface of the irradiated target ~ 1 kJ/cm^2.

The research instruments for studying the samples were X-ray diffractometer DRON - 3, scanning electron microscope JEOL JSM - 840, microdurometer PMT - 3.

As the result of study the formation of stratified physico-mechanical properties and structure of the samples with a periodically changing microhardness depends on depth of the sample, such that the softening layer can damp [1] possible external impact, is observed.

1. *Boiko V I, Valyaev A N, Pogrebnyak A D* Metal modification by high-power pulsed particle beams // Phys. Usp. **42** 1139–1166 (1999)