MODIFICATION OF METAL MATERIALS BY HIGH TEMPERATURE PULSED PLASMA FLUXES IRRADIATION

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The results of the modification of metal materials treated by high temperature pulsed plasma fluxes (HTPPF) with a specific power of incident flux changing in the (3...100)·10^5 W/cm^2 range and a pulse duration lying from 15 to 50 μs have been presented. The results of HTPPF action were studied on the stainless steels of 18Cr-10Ni, 16Cr- 15Ni, 13Cr-2Mo types; on the structural carbon steels of (13...35)Cr, St. 3, St. 20, St. 45 types; on the tool steels of U8, 65G, ShH15 types, and others; on nickel and high nickel alloy of 20Cr-45Ni type; on zirconium- and vanadium-base alloys and other materials. The microstructure and properties (mechanical, tribological, erosion, and other properties) of modified materials and surface alloying of metals exposed to HTPPF action have been investigated.

It was found that the modification of materials by HTPPF resulted in a simultaneous increase of several properties of the treated articles: microhardness of the surface and layers of 40...60 μm in depth, tribological characteristics (friction coefficient, wear resistance), mechanical properties (σ_y, $\sigma_{0.2}$, σ_r) on retention of the initial plasticity (δ), corrosion resistance, radiation erosion under ion irradiation, and others. The determining factor of the changes observed is the structural-phase modification of the near-surface layers, in particular, the formation of the fine cellular structure in the near-surface layers at a depth of 20 μm with dimension of cells changing in the range from 0.1 to 1.5 μm, depending on the kind of material, its preliminary treatment, and the parameters of plasma fluxes.

The results obtained have shown the possibility of purposeful surface alloying of metals exposed to HTPPF action over a depth up to 20...45 μm and the concentration of alloying element (Ni, Cr, V) up to 20 wt.%.

Possible industrial brunches for using the treatment have been also considered, as well as some results on modifying the serial industrial articles by HTPPF.

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