Nanostructured surfaces

Forming of nanostructured elements in the surface layer of the VT1-0 titanium alloy in the process of diffusion saturation with oxygen

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In recent years, in the investigation of the solid-solution strengthening of titanium alloys, main attention has been focused on the determination of factors that improve the fatigue properties of the metal.

It was found that the fatigue life of titanium alloys under different loading conditions can be increased by the regulated gradient solid-solution strengthening (RGSSS) of subsurface layers of the metal in the process of diffusion saturation with interstitial elements [1]. Recall that the maximum increment of the fatigue characteristics of specimens of VT1-0 alloy was fixed in the range $40\ \% < \boldsymbol{K} < 70\%$, and, for this reason, in what follows, we call this RGSSS "optimal" ($\boldsymbol{K} = ((H^s - H^c) / H^c)\cdot 100\%$, where H^s and $H^c$are the mean values of the microhardness of, respectively, the surface and the core of the metal).

We have found that, under "optimal" RGSSS, an ordered cellular dislocation structure is formed fig. 1, which provides the highest fatigue characteristics of the metal against those in the initial state, whereas "overoptimal" RGSSS causes the pre-precipitation of the oxide phase both over the grain body and along grain boundaries and, hence, leads to brittle fracture [2].

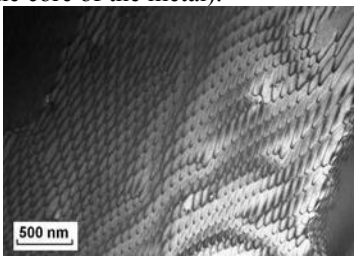

Fig. 1. Microstructure of VT1-0 alloy under "optimal" RGSSS.

1. *Pichuhin A. T., Fedirko V. M., Luk'yanenko O. H. and Onuferko V. S.* Endurance of VT1-0 titanium alloy subject to solid-solution surface hardening // Materials Science, **41**, N. 3, 2005 P. 119–122.

2. *Fedirko V.M., Pichuhin A. T., Luk'yanenko O. H. and Trush V. S.* Evolution of the microstructure of the subsurface layer of VT1-0 titanium alloy in the process of diffusion saturation with oxygen // Materials Science, **48**, N. 5, March, 2013. - P. 43-48.