C3-P-047702

PLASMA THERMAL CYCLIC NITRIDING OF TITANIUM ALLOYS

I.V. KANDAROV[1], A. A. NIKOLAEV[2], E. L. VARDANYAN[2], A. YU. NAZAROV[2], K.N. RAMAZANOV[2]

[1] Tekhnopark AT, Ufa, Russia
[2] Ufa State Aviation Technical University, Ufa, Russia

Today nitriding is one of the effective methods of surface hardening of titanium alloys and steels [1]. However, in the temperature range of 450-550 °C, the process is carried out at long dwell times due to the low rate of nitrogen diffusion deep into the material. The diffusion rate can be significantly increased by various methods of intensifying the process by applying magnetic fields and installing special technological screens, which complicates the design of facilities. Also, the creation of ultrafine grained (UFG) structure by surface plastic deformation methods allows to increase the diffusion rate [2,3]. One of the easy ways to intensify the nitriding process is thermal cycling [4]. The idea of this method is to accelerate the diffusion kinetics by changing the duration of the surface saturation stage and internal nitrogen diffusion deep into the material. With traditional continuous nitriding, the nitride zone grows considerably with increasing dwell time, resulting in slower diffusion. This disadvantage of the process can be eliminated by using the thermocyclic method, thus speeding up nitrogen diffusion.

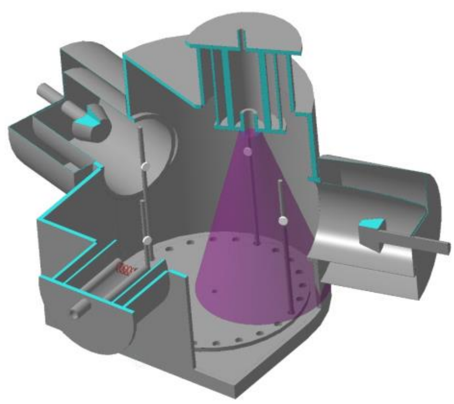

Fig.1. Scheme of thermocyclic nitriding.

In this work, the effect of changing the duration of the nitrogen saturation phase of the surface at different positions of the samples with respect to the plasma source was investigated. To establish the patterns, the roughness before and after nitriding, surface microhardness, and microstructure were examined and comparative tribological tests were performed.

REFERENCES

[1] Li, C. X., & Bell, T. // Corrosion Science. – 2004. – Vol. 46. – №6 . p. 1527-1547.
[2] Brokman, A., Dothan, F., & Tuler, F. // Materials Science and Engineering. – 1979. – Vol. 40. – №2 . p. 261-263.
[3] Brokman, A., & Tuler, F. R. // Journal of Applied Physics. – 2018. – Vol. 52. – №1. p. 468-471
[4] Nalimov Y. S. et al. //Strength of Materials. – 2020. – Vol. 52. – №. 2. – p. 262-267.