

Nanostructured surfaces

Nanostructures formation on the Ti-6Al-4V alloy surface under laser irradiation

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The research of the periodic nanostructured formation on titanium and its alloys surface under the influence of the laser impulses with different durations is now one of the most actively developing directions in the material science. The superficial periodic structures are the most ordered and perspective from the point of view of their usage in medicine, microelectronics, photonics, biosensors, etc.

The surface of Ti-6Al-4V alloy samples was irradiated with laser impulses on air and in argon atmosphere. The parameters of the laser radiation (Nd:YAG) are: $\lambda = 1,06 \mu\text{m}$, $\tau = 4,2 \text{ ms}$, $E = 0,423 \text{ J}$, $q = 114$ and 160 J/cm^2 . The surface and structure morphology created under the laser irradiation was studied by means of Scanning Electron Microscope JSM 6490LV.

It is observed that in the melted zone of Ti-6Al-4V alloy after the treatment on the air laser-induced periodic surface structures (LIPPS, ripples) are formed with the period of 400-500 nm and oriented perpendicularly to the plane of incidence on the surface (fig. 1, a). The formation mechanism of such structures is connected to the resonant mechanisms based on electromagnetic aspects the surface plasmon polariton excitation during the laser impulse. At laser melting in argon atmosphere the formation of pronounced ring structures is observed on the alloy surface (fig. 1, b). The period of such structures varies from 1 to 10 μm . It is observed on the top surface of the ring structure the nanoparticles with the size of 80 - 140 nm.

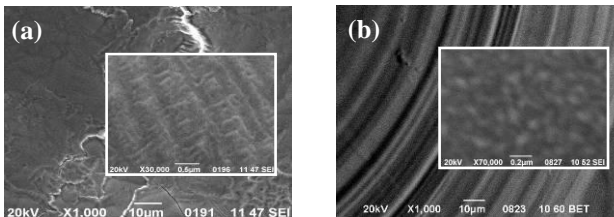


Fig. 1. The laser-induced periodic surface structures on the surface of Ti-6Al-4V alloy under the influence of the laser irradiation on air (a) and in argon (b).