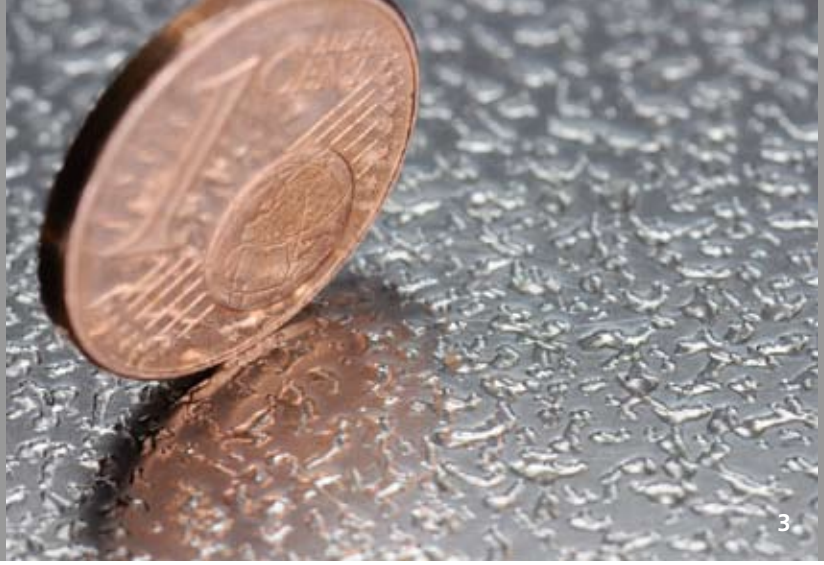

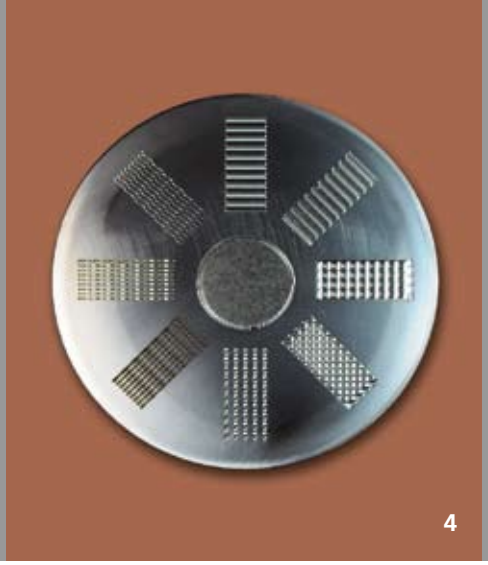

LASER REMELT STRUCTURING (WAVESHAPE) ON TI6AL4V

Task

Today, components with structured surfaces have become essential in many industrial areas. Used for such components, the titanium alloy Ti6Al4V has found a wide range of applications in many branches, beginning with turbine engine components for the aviation and space industry via implants in medical technology all the way to functional and design surfaces for the jewelry sector. The processes currently used to structure surfaces – etching, laser ablation – are, however, time or cost intensive and based on structuring through material ablation. Both of these processes generate rough surfaces, which can only be used to a limited degree in the design sector or in those with high hygienic standards. Moreover, their low ablation rates often constitute a clear shortcoming.

Method

With the newly developed process of laser remelt structuring (WaveShape), a laser beam is guided over the workpiece and melts the surface locally. Simultaneously, the laser power is modulated with frequencies between 10 - 100 Hz so that the melt pool size changes continuously. Thanks to this modulation of the melt pool size, the material is distributed, thus generating mountains and valleys: one half of the arising structure lies above the initial level, one half below. The surface layer hardens directly from the melt pool so that the surface, in addition to being structured, is polished at the same time.
To expand the spectrum of materials that can be processed with WaveShape (to date only 1.2343), systematic experimental tests were conducted for Ti6Al4V within the scope of the project »WaveShape«, funded by the VW Foundation.

Result and Applications

The investigations show that Ti6Al4V is basically suitable for use with laser remelt structuring. In the process, it is shown by means of single tracks that structures can be generated with a single processing step and have a height of more than 20 µm. This corresponds to more than the four-fold of the structure height that can be generated with comparable process parameters on 1.2343 tool steel. Furthermore, the investigations show that the scanning speed can be increased when the process parameters are adapted accordingly, by a factor of four – to 200 mm/s – making it possible to process 200 µm high structures at 30s/cm^2.

This process is suitable for generating a wide spectrum of aperiodic (Figure 3) and periodic (Figure 4) structures. The structured surfaces exhibit a small micro-roughness (Ra < 0.1 µm). Fields of application for such structures lie, among others, in all areas where innovative functional elements (streaming, light scattering) and design elements (optics, haptics) should be used.

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Demonstration object out of Ti6Al4V
3 ... with aperiodic structuring (leather grain).
4 .... with different periodic structures.