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LASER MICRO POLISHING OF IMPELLERS MADE OF TITANIUM

Task

Many three-dimensional freeform surfaces are at present polished manually owing to the lack of automated manufacturing processes. In the case of titanium materials, mechanical polishing also causes smearing, making the surface finish even more difficult to achieve. Manual polishing times here are often over 10 min/cm^2.

For this reason, automated laser polishing for precision milled impellers from MediKomp made out of Grade 2 titanium is being investigated. Pulsed laser radiation can be used, in particular, to remove microroughness from surfaces and to increase the degree of gloss. Apart from the high machining speed, the main advantages relate to process automation and high geometrical accuracy.

Method

Suitable processing parameters for laser polishing are initially determined on flat specimens. The processing of a 3D impeller in a commercially available CAM system is then planned. Data are processed further using a technology module developed at Fraunhofer ILT for the laser polishing process. The NC data generated in this way can be used to process the impellers using a laser polishing machine.

1 Impeller made out of titanium (Ø 43 mm, Grade 2) in precision milled original state (left) and in laser-polished state (right).

Result

The impellers were polished using a rod laser (λ = 1064 nm) with pulse durations in the region of approx. 150 ns at a processing rate of 3.3 s/cm^2. In this way a homogeneous surface was achieved across the component and its microroughness was reduced from Ra = 0.15 µm to Ra = 0.04 µm through polishing.

Applications

In addition to polishing titanium materials, the laser micro polishing process is suitable for many other materials and applications. In particular, the process can automate and substantially speed up the polishing of three-dimensional freeform surfaces.

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