



LASER POLISHING OF VENTRICULAR ASSIST DEVICES MADE OF TITANIUM

Conventional polishing of titanium materials, which are often used in medical engineering, is a time-consuming and labour-intensive process. Therefore, polishing of titanium materials with pulsed laser radiation is investigated. The advantages of laser polishing in comparison to conventional polishing methods are:

- No use of abrasives, therefore surfaces with high chemical cleanliness
- No fine scratches on the surface since the surface is not machined mechanically, but remelted
- Automation, therefore high reproducibility

Method

The investigations are exemplarily carried out with a ventricular assist device (VAD) made of Ti6Al4V. At first, suitable process parameters for laser polishing of the material and the surface roughness of the VAD-components are determined. Then, strategies for the polishing of the implants are developed by use of a CAM-NC process chain. Lastly, the components are polished on a laser polishing machine.

The laser polished surfaces are characterized by white-light interferometry, light microscopy, and scanning electron microscopy. Additionally, biomedical investigations regarding haemocompatibility are conducted by project partners.

1 LM-micrographs of the surfaces,
left: initial surface (milled), right: laser polished

2 Component of VAD (height: ca. 25 mm),
left: milled, right: laser polished.

Results

By laser micro polishing with a pulse duration of about 150 ns, the roughness of the VAD-components is reduced from $R_a = 0.3 \mu\text{m}$ to $R_a = 0.08 \mu\text{m}$. Thereby, particularly the micro roughness is intensely smoothed. The deviation of the surface roughness on the workpiece is very low, hence almost the same surface quality is gained on the whole component. Laser polishing of the implant shown in picture 2 takes about 2 min (conventional polishing: 3 h). Biomedical investigations show that the haemocompatibility of the laser polished components is at least as high as the haemocompatibility of conventionally polished implants.

Applications

Besides polishing of titanium materials for medical engineering, laser polishing is suitable for many other materials and applications. Especially the polishing of three-dimensional free-form surfaces can be automated and extremely be sped up.

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