



1



2

SELECTIVE LASER MELTING OF POLYMER-BASED BIORESORBABLE IMPLANTS

Task

Composites made of polylactic acid, β -tricalcium phosphate (β -TCP) and calcium carbonate can be used to manufacture bioresorbable bone replacement implants with controllable resorption kinetics and adjustable mechanical properties. So far, however, there has not yet been a shaping production method that enables the manufacture of patient-specific implants with an interconnecting pore structure so as to optimize the ingrowth of the bone. In the future, Selective Laser Melting (SLM) could make the production of such customized implants possible. Fraunhofer ILT can already process a composite material of polylactic acid and β -TCP by means of SLM on a laboratory scale. Since the build-up rate achieved is currently too low for the industrial to implement the method, however, it is attempting to increase productivity.

Method

To increase the build-up rate, SLM process and material have been specifically matched to each other. For the process, the SLM process parameters (e.g. scan speed and laser power) have been varied and adapted to the material. For the material, the filler and the polymer chain length have been varied to improve the processability of the material.

Result

By suitably adjusting the SLM process parameters and the material composition, the institute has achieved a 14-fold increase in the real build-up rate. In this case, for simple specimens, a part density of > 95 percent was reached. In addition, complex geometries with an interconnecting pore structure were produced. In the next step, the material shall be improved by the addition of buffering-capable calcium carbonate to neutralize the acid degradation products of the polylactide.

Applications

The method can be used for the production of patient-specific bioresorbable bone replacement implants, whereby the main application field is the maxillofacial area.

The work was carried out within the framework of the project »ActiveBone«, funded by the BMBF (Federal Ministry of Education and Research) on behalf of EOS GmbH, SCHAEFER KALK GmbH & Co. KG and Karl Leibinger Medizintechnik GmbH & Co. KG.

Contacts

M.Sc. Christoph Gayer
Telephone +49 241 8906-8019
christoph.gayer@ilt.fraunhofer.de

Dipl.-Phys. Lucas Jauer
Telephone +49 241 8906-360
lucas.jauer@ilt.fraunhofer.de

1 Bioresorbable skull implant manufactured with SLM (\varnothing approx. 65 mm).

2 Detail photograph of an interconnecting pore structure (\varnothing pore channels: 0.7 mm).