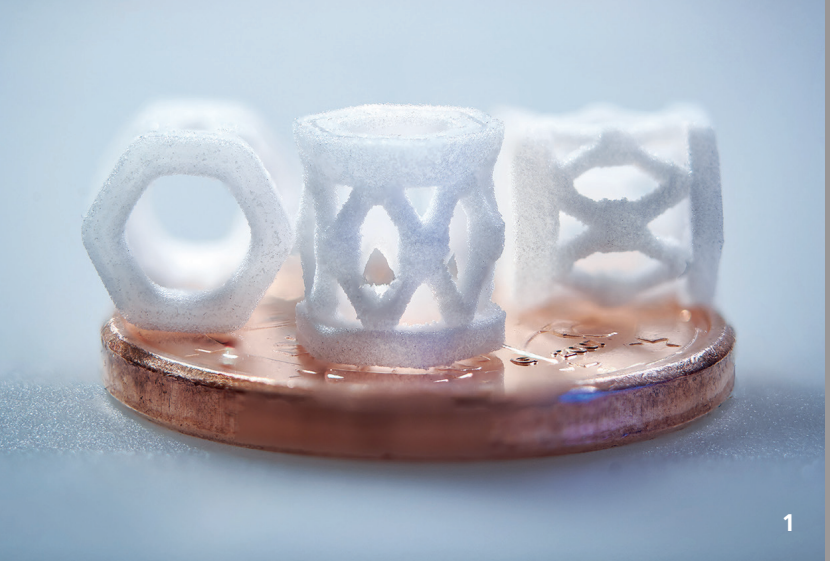

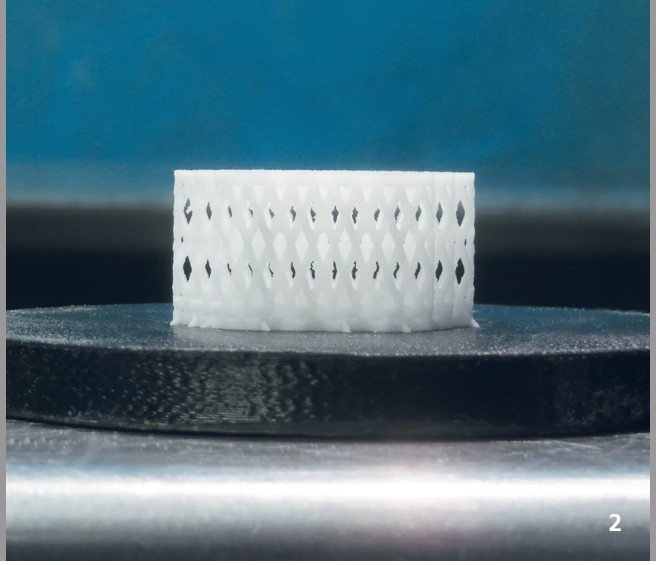

SELECTIVE LASER SINTERING OF BIORESORBABLE SCAFFOLDS FOR BONE REGENERATION

Task

To induce the body to regenerate bone cartilage tissue and bone via an intermediate cartilage phase, Fraunhofer ILT is developing a two-component biomaterial (a mechanical-hybrid scaffold). It consists of a soft collagen component with a directional internal control structure and bioactive microparticles in combination with a resorbable, mechanically supporting secondary structure. This secondary structure should be additively manufactured from the material PCL (polycaprolactone) by a laser sintering process so that its mechanical stability can be specifically adapted.

Method

Before support structures can be manufactured from PCL with selective laser sintering, suitable process parameters need to be determined. The challenge here lies in producing maximally fine structures to provide as much volume as possible for bone growth when the scaffold is placed in the body. At the same time, mechanical stability must be ensured by a high density achieved in the volume material. Fraunhofer ILT uses a flexibly adaptable laboratory facility for process development, which means that it can investigate boundary conditions such as powder deposition or deionization of the powder, in addition to the process parameters.

Results

With optimized process control and adapted process parameters, the institute has produced support structures with strut thicknesses less than 0.45 mm. However, structures with strut thicknesses of 0.6 to 0.7 mm turn out to be more advantageous since these structures achieve a compressive strength of greater than 35 MPa. Furthermore, in combination with collagen, mechano-hybrid scaffolds can be produced. These have already been successfully tested in animal experiments and their biocompatibility has been demonstrated in vivo.

Applications

Mechano-hybrid scaffolds can be used, for example, as medical devices to treat osteochondral defects as well as bone defects or vertebral body fusion.

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1 Support structure for mechano-hybrid scaffolds for small animals.

2 Support structure for mechano-hybrid scaffolds for large animals.