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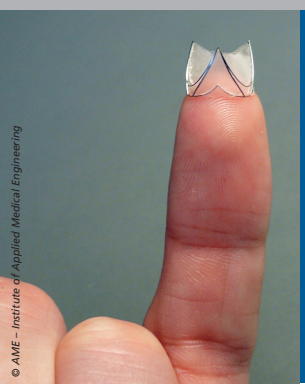

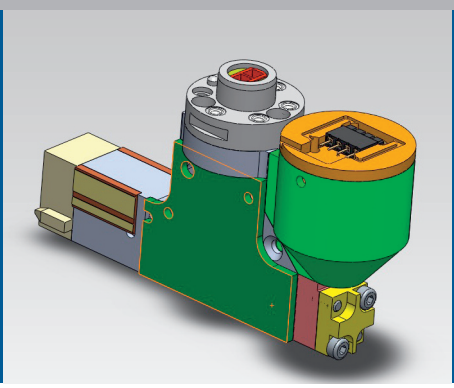

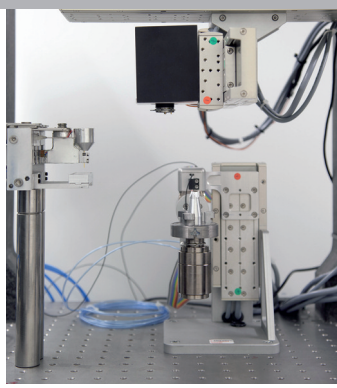

NEW MANUFACTURING PROCESS FOR PLASTIC IMPLANTS WITH OPTIMUM ELASTICITY

New material properties through innovative technology

Functionally graded materials can be found everywhere in animate nature and are characterized by transitions from rigid to flexible and from hard to soft structures. To date, technology could not emulate these structures, for instance in die casting.

One material, one product, different degrees of rigidity and elasticity: this describes the requirements to be met by high-performance near-natural plastic implants with optimum elasticity that are used, for example, as heart and venous valves. In the future, this will be possible thanks to the production process developed by Fraunhofer IPA and the manufacturing technology for automated cleanroom manufacturing.

Technical implementation

In a first step, the polymers dissolved in solvents will be placed dropwise and with high precision on the implant model using a 3D dispensing system. This system dispenses up to 100 droplets with a volume of 2 nl to 60 nl per second. The dosage volume is controlled by PipeJet™ technology. With 6-axis kinematics, the piezo dispenser is positioned above the venous valve model. The different degrees of Shore hardness of a polymer can be cross-linked in layers, creating seamless gradients. Each step of applying a layer is followed by a drying step to remove the solvent.

Results

Three-dimensional geometric objects such as high-performance implants for venous and heart valves can be built from polycarbonate urethane in cleanroom production facilities with an accuracy of 25 µm and different combined degrees of rigidity or elasticity. This is enabled by a generative and automated manufacturing process based on CAD data.

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