Different additive manufacturing techniques for osteoconductive bioceramics fabrication

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Nowadays the promising trend in medicine is a regenerative approach with emphasis on the replacement of the biomaterial with the newly-formed bone. The material is assigned the role of a porous active medium (scaffold) and mainly acting as a guiding function. This approach requires from materials speeding up the process of adhesion and replacement of the implant with new bone tissue, as well as the osteostimulating action, and at the same time withstand high-level mechanical loads during rehabilitation.

Additive manufacturing techniques are the most competitive technology for the medical field for the direct or indirect construction of scaffolds and hard or soft tissues.

Present work gets to grips with the issue of interconnected macropores for bioceramics with special architecture. In this study different 3D-techniques (FFM, SLA) were used to prepare ceramics with given structure based on calcium phosphates with tunable solubility to improve its osteoconductive properties. Different structures including triply-periodic minimal surfaces family were used to reach eligible permeability (up to 1000 Darcy) to reveal osteoconductivity. FEM-analysis of loading (Autodesk Fusion 360) and simulation of fluid flow (Autodesk CFD 2018) through the structure were used to gain the best option.

This talk aims to touch different approaches for the additive fabrication of personalised implants for bone tissue reconstruction and the significance of pore architectonics for its osteoconductive properties.

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