Virtual 3D-Printing of Soft Polymers for Neural Implants

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ABSTRACT

Disorders of the central nervous system are one of the most dominant diseases worldwide. The therapy is mainly based on neural implants. With a patient specific fabrication of these implants an optimal reconstruction of the original behaviour can be achieved. The most easily and efficiently production technology for these demands is Additive Manufacturing. However, for most of the neural implants, like for the cochlea, soft polymers have to be fabricated for the electron arrays. The printing process of these materials is still a huge challenge and its development became a hot research topic. Simulation driven design is a promising way to construct new and optimized 3D printers. However, high fidelity models and efficient computational solution schemes are a prerequisite of this kind of simulation driven engineering.

Within the printing process of soft polymers the shape of the final printed part is controlled by a laser heat source which influences the curing behaviour [1]. Hence, the whole process has to be modelled by means of a multi-physical framework which includes finite mechanical deformations, thermal and chemical reactions [2]. The transition from the visco-plastic uncured paste like behaviour to the fully cured viscoelastic material is modelled by means of a specific yield function. In order to model fusion processes with a low computational effort a modified Peridynamic meshfree solution scheme [3] is applied. The whole algorithm is compared with experimental studies and the influences of the process parameters on the final shape of the printed soft polymer are shown by an evaluation of several results.

REFERENCES

