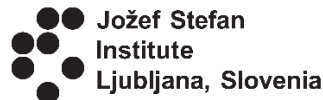




Nanostructured
materials



Jožef Stefan
Institute
Ljubljana, Slovenia

Development of Multicomponent Binder Systems for Accelerated Debinding in Thermoplastic Material Jetting of Ceramics

Background

Thermoplastic Material Jetting (TMJ) is a high-resolution, drop-on-demand additive manufacturing technology where, a wax-based thermoplastic suspension (feedstock) consisting of sterically stabilized ceramic particles is deposited in the form of droplets. Upon deposition, these droplets fuse and solidify into lines, which subsequently merge to form the layers of a ceramic "green body." A high solids loading (typically >40 vol.%) is essential to achieve high green densities, thereby minimizing shrinkage and porosity during the subsequent thermal debinding and sintering stages.

Problem Statement

Traditional thermal debinding is a major bottleneck due to its prolonged processing times. Rapid heating often leads to inhomogeneous binder removal, resulting in defects such as cracking or delamination that compromise structural integrity. While optimizing heating rates and isothermal holds is essential for high final density, there is a critical need for more efficient debinding strategies that significantly reduce duration without sacrificing part quality.

Objectives and scope of the project

The aim of this research is to evaluate the feasibility of a multicomponent binder system for TMJ ceramic feedstocks by utilizing a combination of water-soluble and water-insoluble components. By incorporating a water-soluble binder, a portion of the organic phase can be chemically removed via solvent extraction prior to thermal treatment, thereby accelerating the overall debinding process and reducing defect formation. The scope of this project encompasses the development of novel wax-based feedstock formulations, the fabrication of test specimens using TMJ additive manufacturing, and a final evaluation of the synergistic effects of chemical and thermal debinding on the resulting part quality.

Contact

For more information, please contact: aljaz.ivekovic@ijs.si
Department website: <http://nano.ijs.si/>

Open call. The application is now open.