

Ceramic injection moulding for the manufacture of implants using the example of dental implants

Fraunhofer-Institut für Keramische Technologien und Systeme IKTS

Dr.-Ing. Sabine Begand / Head of Department Oxide Ceramics

With the collaboration of Dr. Sebastian Spange / Group Leader

Abstract

Ceramic Injection Molding (CIM) is presented as a robust and industrially scalable manufacturing route for zirconia-based dental implants and abutments, enabling near-net-shape fabrication with high geometrical precision. The talk outlines the complete CIM process chain, including feedstock formulation, injection molding, debinding, and sintering. Particular focus is placed on the processing of yttria-stabilized zirconia feedstocks, achieving sintered densities above 99% and bending strengths exceeding 1000 MPa. The capability of CIM to produce thin-walled, complex implant geometries with tolerances down to 12 μm while significantly reducing material waste and energy consumption is demonstrated. All process steps are digitally monitored and documented, enabling closed-loop feedback between processing, microstructure, and component performance. Finally, CIM is discussed as a key enabling technology for future dental implants with functionally tailored surfaces, combining smooth gingival regions and osseointegrative bone-contact areas.