Low Viscosity, High-Performance Urethane Formulations Designed for 3D Inkjet Printing

Alexandria, VA, USA – Kyle Sorensen, University of Colorado, University of Colorado Anschutz Medical Campus, Aroura, presented the "Low Viscosity, High-Performance Urethane Formulations Designed for 3D Inkjet Printing" at the hybrid 51st Annual Meeting & Exhibition of the AADOCR, held in conjunction with the 46th Annual Meeting of the Canadian Association for Dental Research (CADR), online and onsite in Atlanta, GA, on March 24, 2022.

Multi-urethane monomers are precursors to polymers with good mechanical properties, but their high viscosities effectively remove them from consideration for low viscosity inks required for inkjet printing. This study introduced extremely low viscosity urethane monomers that can coordinate with select reactive diluent comonomers to achieve resin viscosities in the jettable range while synergistically delivering polymers with outstanding mechanical properties. Integration of these advanced materials with sophisticated voxel-level multi-material design engineering uniquely deployable via multi-head inkjet printing has great potential to influence the evolving world of digital dentistry.

The researchers used a series of novel mono-urethane di(meth)acrylate (MUDMA) monomers to formulate with (meth)acrylic acid (MAA) as a comonomer in equimolar proportions. Monomer and resin viscosities were measured and photopolymerized samples were analyzed for ambient and post-cure degree of conversion. Polymer samples were submitted to mechanical testing in three-point bending to assess modulus, strength, and toughness.

The findings indicate that novel high-performance urethane-based materials that exceed the performance standards of UDMA while providing resins ideally suited to inkjet 3D printing were validated. Preliminary inkjet printing trials have successfully yielded high resolution, structurally complex parts: e.g. an esthetic monolithic denture base/denture tooth demo model.

This research was presented as an in-person Interactive Talk on March 24, 2022 at 3:30 p.m. EDT, view the abstract on the 2022 Annual Meeting Hybrid Platform.

About AADOCR
The American Association for Dental, Oral, and Craniofacial Research (AADOCR) is a nonprofit organization with over 3,000 members in the United States with a mission to drive dental, oral, and craniofacial research to advance health and well-being. AADOCR is the largest division of the International Association for Dental Research which has over 10,000 members. Learn more at www.aadocr.org.