
# Chemistry and Engineering Approaches to Advanced Silicone 3D Printing

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The ability to customize by 3D printing coupled with the material properties of silicone polymers is a powerful combination to serve a wide range of societal needs. However, challenges exist to tune silicone material properties to fit into specific printing techniques, or to engineer printing setups for typical silicone materials to deliver the best quality of printed articles at an economically viable speed. Material and printing technique developments have been reported to address those challenges. A selective chain extension approach has proven successful in significantly reducing the viscosity of silicone pastes before curing, making them much more suitable for material jetting, while maintaining high mechanical toughness of the cured polymer. Force analysis and numerical simulation of the printing process helped identify main sources of several major printing errors in extrusion printing of silicones. Approaches to minimize distortion forces, rheology tuning of silicone pastes, new static mixer designs to reduce pressure drop while maintaining the same mixing efficiency, and machine learning enhanced feedforward error correction resulted in much improved printing fidelity of silicone articles.