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Controlling Fiber Morphology in Simultaneous Centrifugal Spinning and Photopolymerization YICHEN FANG, AUSTIN DULANEY, CHRISTOPHER ELLISON, University of Texas at Austin - McKetta Department of Chemical Engineering — Current synthetic fiber manufacturing technologies use either solvent or heat to transform a solid preformed polymer into a liquid before applying a force to draw the liquid into fiber. While the use of solvent poses concerns regarding process safety and environmental impact, the use of heat may also lead to polymer degradation and excessive energy consumption. To address these critical challenges, here we present an alternative fiber manufacturing method that encompasses extruding a monomer solution through an orifice, drawing it using centrifugal Forcespinning and polymerizing the monomer jet into solid fiber in flight using UV initiated thiol-ene chemistry. This method not only negates the use of both heat and solvent, but also produces fibers that are highly crosslinked, mechanically robust, and thermally stable. In this process, the balance between curing kinetics, fiber flight time, and solution viscoelasticity is essential. Studies were conducted to quantitatively investigate the effect of these factors on fiber formation and morphology. An operating diagram was developed to show how the intricate interplay of these factors led to the formation of smooth fibers and other undesirable fiber defects, such as beads-on-string, fused fibers, and droplets.

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