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A Quantitative Study of the Effect of Flow on the Photopolymerization of Fibers[1] MALCOLM SLUTZKY, HOWARD STONE, JANINE NUNES, Princeton University — The gelation resulting from the interaction between a continuously flowing photo-crosslinkable fluid and pulsed-UV light can be used to produce uniform flexible microfibers. We study this process of fiber production by investigating the conditions required for gelation and by developing a steady-state flow model of the gelation process, which captures the effects of UV exposure on the spatial concentration of radical species and molecular oxygen in the direction of flow. Using this model, we are able to predict critical conditions for fiber production and verify these predictions with our experimentally-observed results. Additionally, we define three regimes of fiber production (in which no fibers, non-uniform fibers, and uniform fibers are produced), qualitatively characterize relationships between fiber length and rigidity, and, with insight drawn from the mathematical model, develop guidelines for the standardized production of uniform fibers with predictable and controllable length.

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