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The role of extensional stress in the formation of electrospun fibers JIAN YU, SERGEY FRIDRIKH, GREGORY RUTLEDGE, Massachusetts Institute of Technology — Electrospinning is a process that employs electrostatic forces to form polymer continuous fibers. Although the process of making electrospun fibers is easy to implement, many polymer solutions are not readily electrospun into uniform fibers. Here we present a study on the role of fluid elasticity in the formation of fibers from polymer solution by electrospinning. For some dilute polymer solutions without elasticity, the electrospinning jet breaks up into droplets due to the Rayleigh instability driven by surface tension. On the other hand, solutions with some degree of elasticity can generate a stress that retards the growth of Rayleigh instability, forming a "beads-on-string" structure. In the extreme case, where a large stress on the jet can suppress the Rayleigh instability completely, uniform fibers are obtained. We calculate a theoretical critical stress on the jet required for complete suppression of the instability. This calculated value is in agreement to experimental observation.

Jian Yu
Massachusetts Institute of Technology

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