Abstract Submitted
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**X-ray imaging of electrospinning polymer solutions**[1] ISRAEL GREENFELD, ARKADII ARINSTEIN, Technion, KAMEL FEZZAA, Argonne National Laboratory, MIRIAM H. RAFAILOVICH, State University of New York, Stony Brook, EYAL ZUSSMAN, Technion — The study of electrospinning polymer solution jets, and the evolution of the polymer entangled network during electrospinning, is of interest in clarifying nanofibers microstructure. We used fast X-ray phase-contrast imaging to investigate the flow of electrospinning PEO and PMMA semidilute solutions. The jet profile, velocity and absorbance were measured at high resolution ($< 1$ $\mu$m/pixel) for the first 10 mm of jet length, at various electrospinning conditions. Jet radius measurements demonstrate a viscosity-dominated flow, with common power-dependence on the distance from the orifice. The flow field was analyzed by imaging solutions with micron-size silica particles, revealing axial velocities of 0.5-1 m/s and strain rates of 200-300 1/s, as well as radial and rotational velocity components. The measured axial velocity provides a direct indication for rapid solvent evaporation as early as 2-3 mm from the jet start. X-ray absorption measurements reveal substantial polymer concentration rise along the jet and at the jet boundaries, evidence for rapid evaporation. Additionally, at high stretching conditions, the polymer concentration rises at the jet center, implying polymer network lateral contraction as predicted by theory.

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