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Pinch-off dynamics, dripping-onto-substrate rheometry and printability of dilute and semi-dilute polymer solutions JELENA DINIC, LEIDY NALLELY JIMENEZ, MADELEINE BIAGIOLI, VIVEK SHARMA, Chemical Engineering, University of Illinois at Chicago — Many advanced manufacturing technologies like inkjet and 3D printing, nano-fiber spinning involve complex free-surface flows, where both shear and extensional rheology affect processability. In applications that involve progressive thinning and break-up of a fluid column or sheet into drops, the dominant flow within the filament is extensional in nature. Polymeric fluids exhibit a much larger resistance to flow in an elongational flow field than Newtonian fluids with same shear viscosity. We use dripping-onto-substrate (DoS) extensional rheometry technique for examining the influence of extensibility, flexibility and concentration on pinch-off dynamics and extensional rheology response of aqueous polyethylene oxide (PEO) solutions, aqueous polyacrylamide (PAM) solutions and aqueous 2-Hydroxyethyl cellulose (HEC) solutions. Both extensional relaxation time and the transient extensional viscosity of dilute and semi-dilute solutions display concentration-dependent behavior that is strikingly different from the response observed in typical shear rheology measurements.

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