Physics > Fluid Dynamics

Visualization of the flow profile inside a thinning filament during capillary breakup of a polymer solution via particle image velocimetry (PIV) and particle tracking velocimetry (PTV)

S. Gier, C. Wagner

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We investigated the flow profile of a polymer solution in a thinning capillary bridge. Fluorescent tracer particles with a diameter of 3μm were used to visualize the flow. The cylindrical shape of the filament introduced strong optical abberations that could be corrected for, and we were able to characterize the flow in filaments with a thickness ranging from 150 to 30 μm. In the first regime when the filament was still sufficiently large, we used a PIV algorithm to deduce the flow field. At later stages when the number of particles in the observation plane decreased a PTV algorithm was used. The main two results of our measurements are as follows. First, the flow profile at the formation of the cylindrical filament is highly inhomogeneous and there is only flow in the outer parts of the filament. Second, we find that in most parts of the regime, where the temporal radius of the thinning filament can be fitted with an exponential law the flow indeed is purely extensional.

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