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Abstract

In the presented study, we have investigated the effect of a complex flow field consisting of a combination of both shear and extensional deformation on the liquid transfer from an idealized gravure cell. The study was conducted for two classes of non-Newtonian fluid; a shear and extensional thickening nanoparticle dispersion and a extensional thickening viscoelastic polymer solution with a constant shear viscosity. The shear thickening fluid was a dispersion of fumed silica nanoparticles in polypropylene glycol and the viscoelastic fluid was a solution of polyethylene oxide (PEO) in water. The idealized gravure printing experiments were conducted using a combination of linear servo motor used to impose an extensional flow and a rotational servo motor to impose a shear flow during pickout. The fluid pickout from the gravure cell was studied as a function of the magnitude of the extensional and shear deformation rates. The fluid filament interface profile evolution during the pickout process was examined using a high speed camera. For the shear thickening fluid, the pickout resulting from a pure extensional flow field was found to be enhanced compared to Newto-

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