NUMERICAL STUDY OF INKJET PRINTING OF WEAKLY VISCOELASTIC INKS

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Inkjet printing is being increasingly used for novel applications, such as 3D printing and printed electric circuits. New formulations of inks under development are often non-Newtonian fluids, which exhibit viscoelastic and shear thinning properties. In order to design and optimise printing processes for these complex inks, the stability of the ink jets and the dynamics of droplet formation must be understood, predictable and controllable at different conditions. The study of drop formation on non-Newtonian inks is still limited [1].

In this work, a Computational Fluid Dynamics model has been developed and used to study jet breakup of complex fluids and understanding the effect of relevant non-dimensional numbers on the dynamics of droplet formation. The rheologic constitutive models used are the Upper-Convective Maxwell Model and the Oldroyd-B model. Simulations of Newtonian fluids have also been performed, in order to see the effect of added viscoelasticity and allow for a direct comparison.

The results of Drop-on-Demand (DOD) printing were compared to results from the literature for Newtonian DOD printing. Additionally, the impact of viscoelasticity on drop formation and different pulse times has also been studied. Continuous Inkjet (CIJ) printing simulations have also been done to study how the different parameter contribute to jet breakup and drop formation without any inlet velocity modulation. By doing so, the parameters ideal for printing viscoelastic inks are defined and can be used in the future to predict the printability of new complex materials.

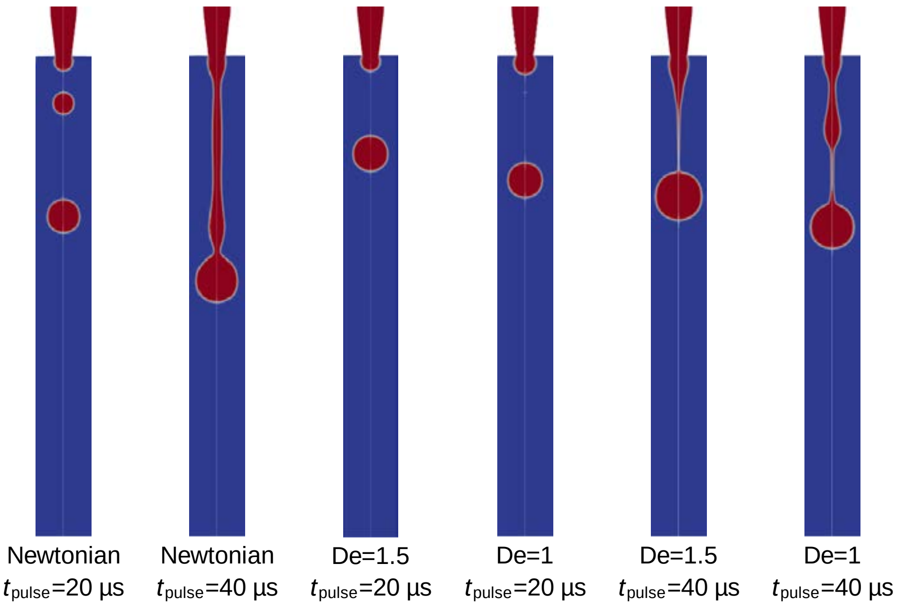

Figure 1 Drop formation a Re=25 and Oh=0.30, for the same flow time.

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