Contribution ID: **568** Type: **Poster (+) Presentation**

Flow instabilities of viscoelastic polymer solutions in multiple contraction channels

Wednesday, 2 June 2021 09:00 (1 hour)

Hydro-soluble polymer solutions are used in porous media for a range of applications from, enhanced oil recovery, ground water remediation and as permeability modifiers in oil reservoirs. During flow of these polymer solutions in porous media, shear viscosity dominates at low and intermediate shear rates, with the polymer solution undergoing a transition from Newtonian to shear-thinning behaviour. However, at high shear rates, the most commonly used synthetic type of polymer exhibits large unstable flows. Previous research in single contraction channels, representing one pore body-pore throat system of a porous medium, have shown that the unstable flows were due to the viscoelasticity of the polymer solution, coupled with the contraction in the microchannel, exhibiting high normal stresses at elevated strain. However, in the presence of multiple pore throats, such as in a porous medium, where there is interaction between different pore throats, the cause and effect of the unstable flows generated need to be fully understood.
Therefore, in this work, we investigate the behaviour of purely elastic flow instabilities of viscoelastic polymer solutions generated in a multiple contraction microfluidic channel. We use micro-channels with throats that are separated by different channel lengths and having contraction ratios, CR, of 5 and 10. Also, we use a time resolved particle imaged flow velocimetry technique, to study the flow behaviours at low fluid inertia and we evaluate the M stability criterion, which predicts the onset of elastic instability. Results showed that flow instabilities, which are elastic in nature, were present above the critical M value. Consequently, we draw conclusions on the effect of the throat separation distance on the flow instabilities.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

Ekanem, E.M., Berg, S., De, S., Fadili, A., Bultreys, T., Rücker, M., Southwick, J., Crawshaw, J. and Luckham, P.F., 2020. Signature of elastic turbulence of viscoelastic fluid flow in a single pore throat. Physical Review E, 101(4), p.042605.

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