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Three-dimensional investigations of the threading regime in a microfluidic flow-focusing channel. KRISHNE GOWDA.V, CHRISTOPHE BROUZET, KTH Royal Institute of Technology, THIBAULT LEFRANC, ENS de Lyon, L.DANIEL SODERBERG, FREDRIK LUNDELL, KTH Royal Institute of Technology — We study the flow dynamics of the threading regime in a microfluidic flow-focusing channel through 3D numerical simulations and experiments. Making strong filaments from cellulose nano-fibrils (CNF) could potentially steer to new high-performance bio-based composites competing with conventional glass fibre composites. CNF filaments can be obtained through hydrodynamic alignment of dispersed CNF by using the concept of flow-focusing. The aligned structure is locked by diffusion of ions resulting in a dispersion-gel transition. Flow-focusing typically refers to a microfluidic channel system where the core fluid is focused by the two sheath fluids, thereby creating an extensional flow at the intersection. In this study, threading regime corresponds to an extensional flow field generated by the water sheath fluid stretching the dispersed CNF core fluid and leading to formation of long threads. The experimental measurements are performed using optical coherence tomography (OCT) and 3D numerical simulations with OpenFOAM. The prime focus is laid on the 3D characteristics of thread formation such as wetting length of core fluid, shape, aspect ratio of the thread and velocity flow-field in the microfluidic channel.

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