Abstract Submitted
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Fiber buckling in confined viscous flows[1] ANKE LINDNER, JEAN CAPPELLO, OLIVIA DU ROURE, PMMH-ESPCI, PSL University, CNRS, Sorbonne University, Paris University, France, CAMILLE DUPRAT, Ladhyx, Polytechnique, France, MATHIAS BECHERT, FRANOIS GALLAIRE, EPFL, Lausanne, Switzerland — Studying fluid structure interactions in confined flows is important to understand locomotion of micro-organisms in soils or medical conducts as well as the movement of long fibers in fractures, where they are used as in-situ probes for example in oil recovery. Here we look at the dynamics of a model system, constituted by flexible fibers freely transported in pressure-driven flows in a Hele-Shaw cell. Fiber height is comparable to channel height and in this very confined geometry the fiber dynamics are dominated by viscous friction with top and bottom walls. We focus on the dynamics of fibers oriented parallel to the flow direction and show that a buckling instability occurs under certain conditions. The fibers deform into a wavy shape resembling a wave-packet, with a well-defined dominant wavelength. Such an instability is triggered by a competition between viscous forces and elasticity and is observed only for long fibers, at least one order of magnitude larger than the observed wavelength. We characterize experimentally the instability and show that the wavelength of the deformation is proportional to an elasto-viscous length. We furthermore study the growth rate of the instability for different fiber geometries, flow strength, and mechanical properties of the fibers.

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Anke Lindner
PMMH-ESPCI

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