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Fabrication of flexible micro-helices and deformation by viscous flows LUCAS PRÉVOST, MARINE DAïEFF, Laboratoire PMMH, UMR7636 CNRS, ESPCI Paris, PSL Research University, Sorbonne Université, Université de Paris, Paris, France, DYLAN BARBER, ALFRED CROSBY, Polymer Science and Engineering Department, University of Massachusetts, Amherst, MA, USA, ANKE LINDNER, OLIVIA DU ROURE, Laboratoire PMMH, UMR7636 CNRS, ESPCI Paris, PSL Research University, Sorbonne Université, Université de Paris, Paris, France — The study of fluid-structure interactions between helical particles and viscous flows is of importance for both fundamental science and technological applications. The chirality of such particles indeed induces breaking of the time-reversal symmetry associated with viscous flows. This effect is exploited by microorganisms to propel themselves through viscous media by rotating helical flagella. Possible applications include swimming micro-robots or flow micro-sensors. We build on a spontaneous formation method of helical ribbons of tunable radii but vanishing pitch. We demonstrate that, by taking advantage of the visco-elasticity of the material, a non-zero pitch can be obtained, by straining the helix over extended periods of time. This two-step technique allows fabrication of flexible micro-helices with unprecedented shape control: the helical radius and pitch and the filament length can be independently tuned. These helices can serve as model systems for the study of fluid-structure interactions. Using this system, we study the deformation of helical ribbons under axial flows created in microfluidic channels. We quantify the influence of the helical radius and helical pitch on the deformation and we observe an effective stiffening as the helical pitch increases.

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