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Deformation of flexible micro helices under flow MARINE DAIEFF, ANKE LINDNER, OLIVIA DU ROURE, PMMH-ESPCI, Paris, France, ALEXANDER MOROZOV, University of Edinburgh, United Kingdom, JONATHAN PHAM, ALFRED CROSBY, University of Massachusetts, Amherst, USA — The interaction of small helices with fluids is important because of its relevance to both fundamental science and technological applications, such as swimming microrobots or microflow sensors. Helically shaped flagella are also exploited by swimming microorganisms to move through their surrounding fluids. Here we study experimentally the deformation of flexible helical ribbons under flow in a microfluidic channel. The size of the helix is typically microscale for the diameter and nanoscale for the thickness. We focus on two different aspects: the overall shape of the helix and the viscous frictional properties. The frictional coefficients determined by our experiments are consistent with calculated values in the context of resistive force theory. Deformation of helices by viscous flow is well-described by non-linear finite extensibility. Due to the non-uniform distribution of the pitch under distributed loading, we identify both linear and nonlinear behavior along the contour length of a single helix. Utilizing our system, we explore the impact of non-Newtonian fluid properties on the mechanics of helix-fluid interactions.

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