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Hydrogel Crawlers in conned channels[1] FRANCK VERNEREY, TONG SHEN, University of Colorado Boulder — Locomotion in conned spaces is common in nature: organisms such as cells and maggots often migrate through porous spaces by establishing contact and frictional forces to propel themselves forward. The development of synthetic particles that share these features is highly desirable in the context of chemical robots and drug delivery systems. In this presentation, we explore the migration of temperature-sensitive hydrogel particles that can crawl in narrow channels via a periodic oscillation of their body and the anisotropic frictional properties of the channels. Experimental measurements show that the particle motion is sensitive to both the presence asymmetric ratchet-like patterns on the channel and the particle confinement. These observations are supported by a model that identies the underlying propulsion mechanisms and predicts the dependency of the particle velocity on its size, aspect ratio, and frictional properties of the substrate. Our results particularly suggest that particle velocity relies on a competition between the kinetics of particle-substrate friction and size-dependent swelling dynamics. We show that sub-micron sized particles are faster regardless of size while the speed of larger particles decreases with their size and stiffness.

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