Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Self-propelling microswimmer made of a bi-faced hydrogel[1]
ALEXANDER ALEXEEV, SVETOSLAV V. NIKOLOV, PETER YEH, Georgia Institute of Technology — We use dissipative particle dynamics to design a new self-propelling microswimmer. Our microswimmer features a simple design and represents an X-shaped gel layer. The gel has two distinct sides or facets: one facet is responsive and swells when an external stimulus is applied, whereas the other facet is passive. We show that when an external stimulus is applied periodically, the swimmer propels itself unidirectionally in a highly viscous fluid. The propulsion is associated with periodic shape changes. When the stimulus is applied, the responsive facet swells, inducing internal stresses in the gel causing both lateral expansion and bending of the microswimmer. When the external stimulus is removed, the responsive layer contracts, and elastic forces cause the microswimmer to straighten and to recover the initial shape. The combination of the sequential expansion, bending, contraction, and straightening produces a time irreversible motion pattern leading to net propulsion at low Reynolds number. We examine how the swimming speed can be enhanced by selecting material properties and geometry of the swimmer.

[1]This work is supported by NSF CAREER award DMR-1255288

Alexander Alexeev
Georgia Institute of Technology

Date submitted: 15 Nov 2013 Electronic form version 1.4