Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Theory and Experiments of Topologically Driven Flows in Nematic Suspensions CHRISTOPHER CONKLIN, JORGE VINALS, University of Minnesota, CHENHUI PENG, YUBING GUO, SERGIJ SHIYANOVSKII, QI-HUO WEI, OLEG LAVRENTOVICH, Kent State University — We present theory, numerical solutions, and experiments of electric field driven flows in nematic liquid crystals (LC) in which a patterned molecular orientation acts as an electrolytic active medium. Surface patterning by photoalignment in a thin cell is used to create various alignments of a nematic liquid crystal film, that may include topological defects. The active patterned LC electrolyte converts electric field energy into LC flows and transport of embedded particles of any type (fluid, solid, gaseous) along predesigned trajectories, and without limitation on the electric nature (charge, polarizability) of these particles and interfaces. Flow is quadratic in the electric field which leads, even for an imposed AC field, to systematic flow velocities, including persistent vortices of controllable rotation speed and direction. The latter are essential for micro- and nanoscale mixing applications.

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Date submitted: 06 Nov 2015 Electronic form version 1.4