Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Life-like functionality and self-organization in a system of communicating polymeric microcapsules GERMAN KOLMAKOV, AMITABH BHATTACHARYA, VICTOR YASHIN, ANNA BALAZS, University of Pittsburgh — We report the results of computational study of self- organization and life-like functionality in a system of polymeric microcapsules in a fluid-filled microchannel. We consider the case where motion of the nanoparticle-filled microcapsules is controlled by adhesion at the channels wall and hydrodynamic coupling between the capsules. Using the hybrid Lattice Boltzmann method for fluid dynamics and Lattice spring model for the micromechanics of elastic solid, we determined how the characteristics of the substrate, the polymeric shell, encapsulated fluid and the surrounding solution affect the capsule's velocity and "gait" of the capsule within the system. In numerical computations we locate the conditions, under which microcapsules communicating through modification of the microchannel surface by released nanoparticles exhibit self-organization, thereby mimicking behavior of the colony of living cells. In particular, we show that this system demonstrates collective, directional motion where a group of target microcapsules is led by a single signaling microcapsule. The results of computations provide guidelines for engineering artificial systems with life-like functionality.

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Date submitted: 29 Dec 2009 Electronic form version 1.4