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Collective behavior and quorum sensing in a system of communicating microcapsules GERMAN KOLMAKOV, AMITABH BHATTACHARYA, ANNA BALAZS, University of Pittsburgh, PROF. ANNA C. BALAZS GROUP TEAM — We report the results on collective motion 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 channel's 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 find the conditions under which microcapsules communicating through modification of the microchannel surface by released nanoparticles exhibit collective motion, thereby mimicking behavior of the colony of living cells. In particular, we show that this system demonstrates a quorum sensing. That is, the capsules motion depends on population and behavior of neighboring groups of capsules. Finally, the design of a repair-and-go system is presented, in which we show that deposition of nanoparticles from moving microcapsules onto a damaged substrate can be used as an effective tool for selective repair of defects or cracks on the substrate.

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