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Modeling the Behavior of Self-Propelled Microcapsules AMITABH BHATTACHARYA, Dept of Chemical Engg, University of Pittsburgh, O. BERK USTA, ANNA C. BALAZS, Dept of Chemical Engg, Univ Pittsburgh — Biological cells can perform complex tasks by signaling and moving autonomously in their environment. We study a system of self-propelled microcapsules, first proposed by Usta et al (2008), that mimics this process. It consists of a signaling and target microcapsule placed close to an adhesive substrate and immersed in fluid. The signaling microcapsule encases nanoparticles, which, when released, modifies the adhesive strength of the substrate. The adhesion gradients in the substrate, along with hydrodynamic interactions among the capsules, gives rise to a sustained motion of the microcapsules. In this work, we perform simulations (based on lattice Boltzmann method for the fluid and random walk simulation for nanoparticles) of several signal-target configurations, consisting of two or more rigid capsules. In particular, we examine a configuration consisting of a single signaling capsule pushing multiple target capsules in a single file. For a constant release rate of nanoparticles, the velocity of the train of capsules asymptotes to a constant value at large times. Using a low-order analytical model for this system, we show that there is a simple relationship between this asymptotic velocity and the parameters in the system (e.g. number of capsules, release rate of nanoparticles, viscosity of fluid, adhesive strength of substrate etc.).

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