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Collective Self-Propelled Motion Of Microcapsules O. BERK USTA, ALEXANDER ALEXEEV, ANNA C. BALAZS, University of Pittsburgh — We study the collective motion of two capsules on a substrate, using a coupling of lattice-Boltzmann method for fluid flow and lattice-spring method for simulation of elastic solids. One of the capsules acts as a seeder of nanoparticles which can reduce or increase the adhesive properties of the surface. The release, of nanoparticles, is modeled as a random diffusive process. Since this process is symmetric, for the case of a single particle, either no motion or/and a random direction is expected depending on the sequence of the random numbers and the strength of the perturbation due to adhesion gradients. However, with the addition of an empty microcapsule, the symmetry is broken. In the first case, where nanoparticles reduce surface adhesion, the second capsule moves on an adhesion gradient created by the seeding capsule and in turn moves the seeder capsule thorugh hydrodynamic interactions. Eventually both capsules can sit on an adhesion gradient and sustain their motion as long as the first capsule can spread nanoparticles. We identify the parameters and conditions for the motion to be sustained. We also study the inverse problem where the nanoparticles increase the surface adhesion. In this scenario, a capsule can signal a distant capsule to move towards it.

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