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Mechanically Activated Motion of a Single Self-Propelled Polymeric Microcapsule GERMAN KOLMAKOV, ALEXANDER SCHAEFER, Chemical Engineering Department, University of Pittsburgh, IGOR ARANSON, Materials Science Division, Argonne National Laboratory, ANNA BALAZS, Chemical Engineering Department, University of Pittsburgh — Using a hybrid computational approach, we demonstrate that a single nanoparticle-filled microcapsule on a rigid substrate can undergo self-sustained motion in response to initial mechanical deformation. Nanoparticles released from the capsule modify the underlying substrate and the adhesion gradients of the nanoparticle concentration formed at the surface sustain the motion of the capsule. The permeability of the microcapsule's shell increases with its deformation and therefore, more deformed microcapsules release nanoparticles at higher rates. An initial, non-uniform mechanical deformation of the capsule by an applied force causes an asymmetry in the nanoparticle distribution on the substrate that initiates the microcapsule motion. We also develop a two-dimensional model of the phenomenon within the phase-field approximation and compare the results of the two approaches.

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