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Release of nanoparticles from mobile microcapsules: designing artificial "leukocytes" for microfluidic devices ALEXANDER ALEXEEV, ROLF VERBERG, ANNA C. BALAZS, Chemical Engineering Department, University of Pittsburgh — We present a novel algorithm to simulate the release of nanoparticles from a microcapsule as it rolls along an adhesive substrate, as well as the subsequent particle adsorption on the wall. The microcapsules consist of an elastic shell that encloses a fluid with a suspension of nanoparticles. This microcapsule is immersed in an external host fluid. A pressure gradient is applied to drive the flow. We focus on a single capsule, which interacts with the substrate through an adhesive interaction that keeps the capsule rolling along the surface. We examine how the adsorption of nanoparticles is affected by the adhesion strength between the capsule and substrate, as well as by the membrane stiffness. To regulate the movement of capsules, we exploit the fact that the adhesion strength between the capsule and the substrate could be different for an "untreated" surface and a surface with a coating of nanoparticles. This could be utilized to repair an area where the coating is damaged. Releasing nanoparticles from the microcapsule allows one to "repair" the area, before the capsule continues its motion along the surface. Our findings yield guidelines for efficient localized delivery of an active ingredient onto a substrate.

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