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Transporting Janus Nanoparticles Using Self-Healing Vesicles XIN YONG, EMILY CRABB, NICHOLAS MOELLERS, ISAAC SALIB, GERALD MCFARLIN, OLGA KUKSENOK, ANNA BALAZS, University of Pittsburgh — Using dissipative particle dynamics (DPD) simulations, we model the interaction between nanoscopic lipid vesicles and Janus nanoparticles in the presence of an imposed flow. Both the vesicle and Janus nanoparticles are localized on a hydrophilic substrate and immersed in a hydrophilic solution. The fluid-driven vesicle successfully picks up Janus particles on the substrate and transports these particles as cargo along the surface. With the introduction of a "sticky" domain or a nanoscale crack onto the otherwise flat substrate, the vesicles can robustly drop off and deposit the particles at the targeted places. For Janus particles with a large hydrophobic region, the vesicle tears and deposits the particle with a few lipids covering its hydrophobic region. This lipids coating can protect the particle from the outer solution after deposition. The vesicle then heals itself after tearing off the lipids, and could be reused for transporting particles. These environmentally adaptive and self-healing vesicles can play an important role in drug-delivery and microfluidic applications.

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