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Chemically generated convective transport of micron sized particles OLEG SHKLYAEV, The University of Pittsburgh, SAMBEETA DAS, ALICIA ALTEMOSE, The Pennsylvania State University, HENRY SHUM, ANNA BALAZS, The University of Pittsburgh, AYUSMAN SEN, The Pennsylvania State University
— A variety of chemical and biological applications require manipulation of micron sized objects like cells, viruses, and large molecules. Increasing the size of particles up to a micron reduces performance of techniques based on diffusive transport. Directional transport of cargo toward detecting elements reduces the delivery time and improves performance of sensing devices. We demonstrate how chemical reactions can be used to organize fluid flows carrying particles toward the assigned destinations. Convection is driven by density variations caused by a chemical reaction occurring at a catalyst or enzyme-covered target site. If the reaction causes a reduction in fluid density, as in the case of catalytic decomposition of hydrogen peroxide, then fluid and suspended cargo is drawn toward the target along the bottom surface. The intensity of the fluid flow and the time of cargo delivery are controlled by the amount of reagent in the system. After the reagent has been consumed, the fluid pump stops and particles are found aggregated on and around the enzyme-coated patch. The pumps are reusable, being reactivated upon injection of additional reagent. The developed technique can be implemented in lab-on-a-chip devices for transportation of micro-scale object immersed in solution.

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