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Versatile particle delivery into dead-end pores enabled by reactive solutes[1] XIAOYU TANG, NAN SHI, ANIRUDHA BANERJEE, TODD SQUIRES, UC Santa Barbara — Particle delivery/extraction in dead-end pores is critical in many applications such as drug delivery and oil recovery. However, convective flow is suppressed due to geometrical confinement, while particle diffusion is prohibitively slow. Diffusiophoresis, in which solute concentration gradient drives particle migration, provides a promising strategy. The solute gradient is commonly imposed by introducing a solution of higher or lower concentration and relying on solute diffusion. However, single solute offers very little control over the particle delivery speed. Here, we present a new and versatile strategy to create solute gradient for diffusiophoretic particle migration: chemical reaction. Different model systems are demonstrated including acid-base and precipitation reactions. We will demonstrate that the speed and concentration of the particles can be controlled by varying reactant concentration ratio and reactant diffusivity ratio. Different particle delivery pattern can be achieved: non-focusing or focusing, where particles are delivered in a concentrated band. A theoretical model for the particle delivery dynamics agree well with the experiment. Diffusiophoresis under reactive solute gradient opens up new possibilities to manipulate particle migration in many configurations and applications.

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