558d Tethering Flexible Magnetic Chains on a Surface Using Microcontact Printing

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Magnetic colloids, in which magnetic nanoparticles are distributed in a polystyrene matrix or emulsion (typically 400-800 nm with 37 wt% magnetic material), are used as a model system to study the behavior of magnetorheological (MR) fluids because the beads self-assemble to form chains under the application of an external magnetic field. This aggregation is reversible and, owing to Brownian motion, the colloidal particles return to their freely dispersed state once the magnetic field is removed. The self-assembly of magnetic colloids can be further exploited to create permanently linked chains of these polarizable particles that have several interesting potential applications since their suspensions have a dynamic structure both in the presence and absence of a magnetic field. They can be used as micromechanical sensors as micromixers and in DNA and other bio-separation processes that use rigid obstacles (e.g., columns of aligned magnetic particles) to impede the convective transport of biological species. Herein we demonstrate an inexpensive and versatile technique to produce stable, tethered, magnetic flexible chains in which it is possible to manipulate the magnetic and surface properties of the beads The magnetic particles used to form these chains were polystyrene beads coated with polyelectrolyte (PE) layers and maghemite (ƒ×-Fe2O3) nanoparticles creating a core-shell structure. Carboxyl groups were functionalized on the core-shell magnetic beads and were used to link adjacent beads with a diamine linker using amidation chemistry. Microcontact printing was employed to stamp the amine functionality on a glass surface, which enabled selective chain growth and linking to the surface. The synthesis and modeling of dynamic response of these chains under an applied magnetic field (stationary and rotating) will be discussed.