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Making molecular changes visible using near-surface transport of micron-sized magnetic particles

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Transport of magnetic particles (MPs) in liquid close to the surface of a flat substrate containing a periodic magnetic domain pattern is a promising lab-on-a-chip (LOC) technology for detecting MP-bound analytes, even when their size is negligible compared to the MP size [1]. As proof of principle, we show that simple observation of MP motion via optical microscopy is sufficient to distinguish MPs of the same nominal size, but surface-functionalized with two different functional groups. The different surface chemistry changes the liquid-mediated MP-to-substrate forces acting during close-to-surface transport, resulting in significant variations in the experimentally observable MP velocity [2]. More specifically, superparamagnetic MPs measuring 2 micrometres in diameter with a polymer coating of solely carboxyl (COOH) end groups, or a mixture of carboxyl and amino (NH2) groups, respectively, have been studied. Transport of these MPs above a magnetic stripe domain pattern in double-distilled water showed a remarkable difference in their average velocities, rendering the COOH-functionalized MPs almost twice as fast as the NH2 counterparts for otherwise identical experimental parameters. This result enables the magnetophoretic separation of MPs based on their surface properties.

References

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