On-chip measurements of Brownian relaxation of magnetic beads with diameters from 10 nm to 250 nm

We demonstrate the use of planar Hall effect magneto resistive sensors for AC susceptibility measurements of magnetic beads with frequencies ranging from DC to 1 MHz. This wide frequency range allows for measuring Brownian relaxation of magnetic beads with diameters ranging from 10 nm to 250 nm. Brownian relaxation is measured for six different magnetic bead types and their hydrodynamic diameters are determined. The hydrodynamic diameters are found to be within 40% of the nominal bead diameters. We discuss the applicability of the different bead types for volume-based biosensing with respect to sedimentation, magnetic trapping, and signal per bead. Among the investigated beads, we conclude that the beads with a nominal diameter of 80 nm are best suited for future on-chip volume-based biosensing experiments using planar Hall effect sensors.

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