Wall-effects of colloidal materials in confined geometries

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The study of colloidal particles confined in channels is important in the modeling of other systems, including vascular tissue in biological systems. It has previously been noted that walls in quasi-two-dimensional systems create stratification in the transverse distribution of particles, resulting in a density variance across the channel. By studying the variation of diffusion along different strata, we can see a correlation between density and motion within a single channel system. For this experiment, we use a colloidal solution of silica spheres (diameter = 1.58 μm), suspended in water. This solution is placed on a polymer mold, consisting of channels with widths between 8 and 20 μm. We found significant variation in self-diffusion along different strata, with higher density strata near the wall having the lowest diffusion coefficients. In the process of stratification, walls create what are essentially a series of quasi-one-dimensional channels with different densities and correspondingly different rates of diffusion.