Confinement Effect on a Superparamagnetic Nanocolloidal Suspensions

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Nanocolloidal suspensions of iron oxide have a high surface area and can be controlled by an external magnetic field. Since they have a fast response to the applied magnetic field, these systems have been used for numerous *in vivo* applications, such as MRI contrast enhancement, tissue repair, immunoassay, detoxification of biological fluids, hyperthermia, drug delivery, and cell separation. Previous studies show numerous challenges have to be overcome to provide new efficient and specific iron oxides for cellular and molecular imaging. We performed shadowgraph imaging experiments in order to investigate the concentration-driven fluctuations using magnetic nanoparticles in the absence and in the presence of vertical and horizontal magnetic fields. Our shadowgraph experimental setup includes a glass cell filled with a magnetic nanocolloidal suspension and water with the concentration gradient oriented against the gravitational field and a superluminescent diode (SLD) as the light source. The magnetic field is produced by two Helmholtz coils, and previous data analysis shows that the power law exponents for the structure factor decrease due to the formation of nano-rods in the presence of a magnetic field. We performed experiments using cells of different geometry, same diameter but different heights, to verify the influence of confinement on non-equilibrium concentration fluctuations. We used a dynamic structure factor algorithm for image processing in order to compute the structure factor, to find the power law exponents, and to determine the correlation time of fluctuations.