3D-Modeling of Magnetophoretic Separation of Superparamagnetic Dispersions Using COMSOL Multiphysics® Particle Tracing Module

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Abstract

Magnetophoresis is a process of great interest for novel applications based on magnetic nanoparticles and colloids. Environmental applications like wastewater treatments and pollutant removal, biomedical applications like protein isolation, drug delivery, magnetic hyperthermia for cancer treatment, and magnetic-particle imaging are just a few of the numerous technological areas which exploit the effect of magnetophoresis. In general, there are two main different types of magnetophoresis processes: cooperative magnetophoresis, a fast process enhanced by particle-particle interactions and noncooperative magnetophoresis which is driven by the motion of independent particles in magnetic gradient fields [1]. Using COMSOL Multiphysics® Particle Tracing Module we have created a 3D-model to analyze noncooperative magnetophoretic separation of superparamagnetic dispersions in space and time (Figure 1).

Reference

[1] J.S. Andreu et al., “Simple analytical model for the magnetophoretic separation of superparamagnetic dispersions in a uniform magnetic gradient”, Phys. Rev. E 84, 021402 (2011)

Figures used in the abstract

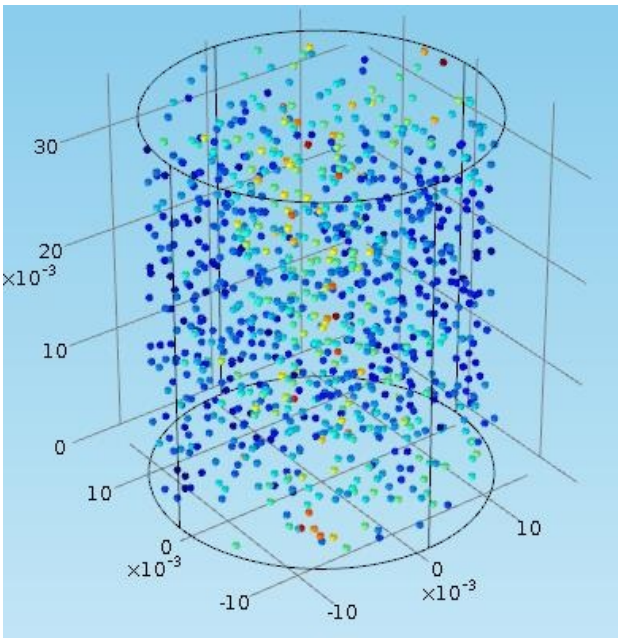

Figure 1: Snapshot of the simulated magnetophoric separation of a superparamagnetic dispersion.