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Application of nonequilibrium concentration profiles in particle diffusion under the action of a magnetic force (abstract)

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For submicron particles diffusion effects and interparticle interactions cannot be neglected in studies of particle behaviour under the action of a magnetic force. Several authors have studied the case of single wire HGMS, where these effects lead to the phenomenon of dynamic buildup: a concentration gradient is induced, but no actual capture occurs. Applications are in, e.g., magnetohydrodynamic separation¹ and susceptibility selective separation.² These applications are based on the equilibrium situation. We have studied the case of nonequilibrium concentration through a numerical solution of the time-dependent diffusion equation, and have found interesting features, that may lead to new applications. The magnetic force will cause a depletion of (ferro)magnetic particles at one end of the sample cell at a size-dependent speed. Observation of the time evolution of the particle concentration at some distance from the end of the cell will then allow to deduce the particle size distribution.

¹U. Andres, *Minerals Sci. Eng.* 7, 99 (1975).

²J. Y. Hwang, M. Takayasu, F. J. Friedlaender, and G. Kullerud, *J. Appl. Phys.* 55, 2595 (1984).