Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Measuring the transverse magnetization of rotating ferrofluids MANFRED LÜCKE, J. EMBS, S. MAY, C. WAGNER, A. KITYK, A. LESCHHORN, University Saarbrücken — We report on measurements of the transverse magnetization of a ferrofluid rotating as a rigid body in a constant magnetic field, $\mathbf{H}_0$, applied perpendicular to the axis of rotation. The rotation of the fluid leads to a non-equilibrium situation, where the ferrofluid magnetization, $\mathbf{M}$, and the magnetic field within the sample, $\mathbf{H}$, are no longer parallel to each other. The off-axis magnetization perpendicular to $\mathbf{H}_0$ is measured as a function of both the applied magnetic field, H_0, and the angular frequency Ω. The latter ranges from a few Hz to frequencies well above a characteristic inverse Brownian relaxation time. Our experimental results strongly indicate that the transverse magnetization is caused only by a small fraction of the collodial ferromagnetic particles. The effect of the polydispersity of the ferrofluid is discussed. Experimental results are compared to predictions based on several theoretical models. A single-time relaxation approach for the so-called effective field and a field dependent Debye relaxation of $\mathbf{M}$ yield reasonably good shapes of the curves of transverse magnetization versus Ω. However, like the other models they overestimate their magnitudes.

Manfred Lücke
University Saarbrücken

Date submitted: 30 Nov 2005 Electronic form version 1.4