FM4S_11982

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Effective Magnetoviscosity for Ferrofluid Planar Couette Flow

Xiaowei He, **Markus Zahn**

Massachusetts Institute of Technology, USA

Ferrofluid spin velocity, shear stress, and magnetoviscosity are calculated for a planar duct Couette ferrofluid flow, with an applied uniform DC magnetic field transverse to the duct axis using Shliomis' first magnetization relaxation equation, generally valid for low magnetic fields. For simplicity, we take the ferrofluid to be linearly magnetizable with constant magnetic susceptibility χ_0. The solution for the axial flow is then while the spin velocity is spatially constant, where both and the change in viscosity, η, due to the magnetic field obey a 5th order algebraic torque equation. This analysis generalizes earlier analyses which had a 3rd order algebraic torque equation, and shows the importance of specifying the magnetic field source in order to best choose or as the independent variables describing the ferrofluid flow spin velocity and change in magnetoviscosity. The best choice magnetic field independent variable does not depend on ferrofluid magnetization or spin velocity.

View the extended summary