Abstract Submitted
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Three-dimensional simulations of thin ferro-fluid films and drops in magnetic fields[1] DEVIN CONROY, ALEX WRAY, OMAR MATAR, Imperial College London — We consider the interfacial dynamics of a thin, ferrofluidic film flowing down an inclined substrate, under the action of a magnetic field, bounded above by an inviscid gas. The fluid is assumed to be weakly-conducting. Its dynamics are governed by a coupled system of the steady Maxwells, the Navier-Stokes, and continuity equations. The magnetisation of the film is a function of the magnetic field, and is prescribed by a Langevin function. We make use of a long-wave reduction in order to solve for the dynamics of the pressure, velocity, and magnetic fields inside the film. The potential in the gas phase is solved with the use of Fourier Transforms. Imposition of appropriate interfacial conditions allows for the construction of an evolution equation for the interfacial shape, via use of the kinematic condition, and the magnetic field. We consider the three-dimensional evolution of the film to spawise perturbations by solving the non-linear equations numerically. The constant flux configuration is considered, which corresponds to a thin film and drop flowing down an incline, and a parametric study is performed to understand the effect of a magnetic field on the stability and structure of the formed drops.

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