Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Mixing in Oscillatory Flows Generated by Electromagnetic Forcing ALDO FIGUEROA, CIE-UNAM, PATRICE MEUNIER, IRPHE, SERGIO CUEVAS, EDUARDO RAMOS, CIE-UNAM — The continuously driven laminar flow produced by an oscillating electromagnetic force in a thin electrolytic fluid layer is studied experimentally and numerically. The flow is generated by the interaction of an injected alternate electric current and a steady magnetic dipole field normal to the layer. Alternate currents with frequencies and amplitudes in the range of 10-50 mHz and 1-5 mA, respectively, are explored. The electromagnetic force stirs the fluid and produces an oscillating dipole vortex that enhances the fluid mixing. A numerical 2D solution of the full MHD equations that considers an analytical expression to model the non-uniform magnetic field is obtained. The mixing efficiency is measured by the use of a new semi-Lagrangian numerical scheme which allows to solve the diffusion of a scalar at very high Peclet numbers (up to infinite). This method gives the scalar field as a function of time and also allows to reconstruct the PDF of the scalar analytically as a measure of the degree of mixing. Numerical results show a good qualitative agreement with the experiments. The mixing can be enhanced even more when an array of magnetic dipole fields is considered.

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Date submitted: 04 Aug 2008 Electronic form version 1.4