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MIXING IN LIQUID METAL BATTERIES

Caroline Nore¹, Wietze Herreman¹, Sabrina Bénard¹, Paolo Personnettaz², Loïc Cappanera³, and Jean-Luc Guermond⁴

¹ Université Paris-Saclay, CNRS, LIMSI, 91400 Orsay, France, caroline.nore@limsi.fr, wietze.herreman@limsi.fr, sabrina.benard@ens-paris-saclay.fr, <https://www.limsi.fr>

² Helmholtz-Zentrum Dresden - Rossendorf, Bautzner Landstr. 400, 01328 Dresden, Germany, p.personnettaz@hzdr.de

³ Department of Mathematics, University of Houston, Houston, TX 77204-3008, USA, loic.cappanera@gmail.com

⁴ Department of Mathematics, Texas A&M University, College Station, TX 77843-3368, USA, guermond@math.tamu.edu

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Liquid Metal Batteries (LMB) are composed of three layers of fluids (liquid metal electrode–electrolyte–liquid metal electrode) of different densities lying over each other and stabilized by gravity. The composition of the positive/bottom electrode of an LMB may become very inhomogeneous over charge/discharge cycles, which limits the battery efficiency. Yet rotational flows in electrically conducting fluids can be generated by the Electro-Vortex-Flow (EVF) phenomenon, i.e. the interaction of a non-uniform current with the magnetic field it generates [1]. Using axisymmetric and fully three-dimensional numerical simulations with the multiphase magnetohydrodynamic code SFEMaNS [2], we investigate whether the mixing induced by the EVF mechanism can help homogenize the positive electrode against buoyancy during charge/discharge cycles.

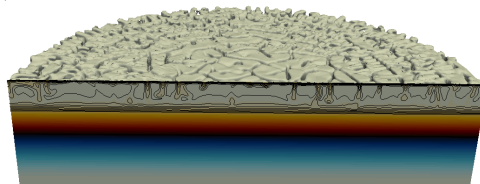


Figure 1: Molar fraction of Li atoms in the positive/bottom electrode during the charge of a Li||Pb liquid metal battery after a discharge.

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