Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Azimuthal swirl in liquid metal electrodes and batteries RAKAN ASHOUR, DOUGLAS KELLEY, Univ of Rochester — Liquid metal batteries consist of two molten metals with different electronegativity separated by molten salt. In these batteries, critical performance related factors such as the limiting current density are governed by fluid mixing in the positive electrode. In this work we present experimental results of a swirling flow in a layer of molten lead-bismuth alloy driven by electrical current. Using in-situ ultrasound velocimetery, we show that poloidal circulation appears at low current density, whereas azimuthal swirl becomes dominant at higher current density. The presence of thermal gradients produces buoyant forces, which are found to compete with those produced by current injection. Taking the ratio of the characteristic electromagnetic to buoyant flow velocity, we are able to predict the current density at which the flow becomes electromagnetically driven. Scaling arguments are also used to show that swirl is generated through self-interaction between the electrical current in the electrode with its own magnetic field.

Rakan Ashour
Univ of Rochester

Date submitted: 28 Jul 2016 Electronic form version 1.4