Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Perturbations of the magnetic induction in a bubbly liquid metal flow. RAFAEL GUICHOU, PHILIPPE TORDJEMAN, WLADIMIR BERGEZ, REMI ZAMANSKY, Institut de Mcanique des Fluides de Toulouse, KEVIN PAUMEL, CEA Cadarache — The presence of bubbles in liquid metal flow subject to AC magnetic field modifies the distribution of eddy currents in the fluid. This situation is encountered in metallurgy and nuclear industry for Sodium Fast Reactors. We will show that the perturbation of the eddy currents can be measured by an Eddy Current Flowmeter coupled with a lock-in amplifier. The experiments point out that the demodulated signal allows to detect the presence of a single bubble in the flow. The signal is sensitive both to the diameter and the relative position of the bubble. Then, we will present a model of a potential perturbation of the current density caused by a bubble and the distortion of the magnetic field. The eddy current distribution is calculated from the induction equation. This model is derived from a potential flow around a spherical particle. The total vector potential is the sum of the vector potential in the liquid metal flow without bubbles and the perturbated vector potential due to the presence of a bubble. The model is then compared to the experimental measurements realized with the eddy current flow meter for various bubble diameters in galinstan. The very good agreement between model and experiments validates the relevance of the perturbative approach.

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Date submitted: 28 Jul 2017 Electronic form version 1.4