Max-Planck-Institut für Plasmaphysik
EURATOM Association

25th Symposium on Fusion Technology
15 - 19 September, 2008, Rostock, Germany

25th SOFT 2008

P1.82 (Poster/Topic H : Fuel Cycle and Breeding Blankets): Mon, 16:00–18:00 Foyer

Measurements of time-dependent liquid metal magnetohydrodynamic flows in a flat rectangular duct

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As a European reference concept for a liquid metal breeding blanket to be tested in ITER the helium cooled lead lithium (HCLL) blanket has been chosen. In this design the heat is removed by helium cooled plates which are aligned with the strong toroidal magnetic field that confines the fusion plasma. The liquid breeder lead lithium circulates through gaps of rectangular cross section between the cooling plates with a minimum velocity that is required to transport the generated tritium towards external facilities where it is separated from the liquid metal.

Magnetohydrodynamic liquid metal flows in conducting rectangular ducts exhibit jet-like velocity profiles in the thin boundary layers near the side walls which are aligned with the magnetic field like the cooling plates in HCLL blankets. The velocity in these so-called side layers may exceed several times the mean velocity in the duct, and it is known that these layers become unstable for sufficiently high Reynolds numbers. The present paper summarizes experimental results for such unstable time dependent flows in strong magnetic fields, which have been obtained in the MEKKA liquid metal laboratory of the Forschungszentrum Karlsruhe. In particular, spatial and temporal scales of perturbation patterns are identified. The observed time dependent flows could result in increased transport properties compared to steady state laminar flows that should be taken into account in future analyses of corrosion and tritium permeation into helium cooling channels.