



Experimental MHD-flow analyses using a mock up of a test blanket module for ITER

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A promising candidate for a breeding blanket in future fusion reactors is the helium cooled lead lithium (HCLL) blanket that is foreseen as a test blanket module in ITER to demonstrate its reliable performance with respect to heat transfer and tritium breeding capabilities. In this type of blanket the heat is entirely removed by helium flowing in small channels within cooling and stiffening plates. The liquid breeder, PbLi, moves only slowly through the breeder units to allow tritium removal and purification in external facilities. The flow of the electrically conducting breeder under the influence of the strong magnetic field confining the fusion plasma leads to magnetohydrodynamic (MHD) phenomena such as induced electric currents, higher pressure drop and different velocity profiles compared with hydrodynamic flows.

In support to the design of an ITER test blanket module a scaled MHD mock-up of a HCLL blanket module with several breeder units and manifolds has been built according to an original design concept developed at CEA. The mock-up has been inserted into the liquid metal loop of the MEKKA laboratory at the Forschungszentrum Karlsruhe and MHD experiments are currently being performed. Results for pressure drop in breeder units and manifolds, and electric surface potential distributions are presented for several liquid metal flow rates and different strengths of the applied uniform magnetic field. These results serve as validation data for numerical tools and provide the necessary input for relevant scaling laws required during the design phase of the ITER TBM.