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ITR/P5-15: Preliminary Corrosion Studies on Structural Materials in Lead-Lithium for Indian LLCB TBM

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Liquid Lead-Lithium (Pb-Li) eutectic is considered as one of the promising candidates of tritium breeder materials for fusion reactors. Several experiments have been conducted to study the corrosion of different structural materials with Lead Lithium eutectic Pb-Li [1-3]. Series of experiments on compatibility of candidate structural materials such as P-91 (9Cr,1Mo Ferritic Steel) and Indian specific RAFMS with Pb-Li are being attempted under Indian TBM R&D program[4]. Two parallel experiments were conducted in Pb-Li buoyancy loop and in a electromagnetic pump driven loop, in the presence and absence of magnetic field.

In buoyancy loop, hot leg is maintained at a temperature of 5500C and cold leg is maintained at a temperature of 4650C. Typical liquid metal velocity was ~ 8 cm/sec. Flat and tensile sample chains of Indian specific RAFMS were kept in both hot and cold legs. This experiment was carried out for 1900 hours.

A experiment in pump driven loop was performed in the set-up at IPUL, Latvia, to study the corrosion of Ferritic Martensitic steel P91 (9% Chromium and 1 % Molybdenum) with /without the presence of magnetic field (1.7 Tesla). Flat and tensile samples were exposed to flowing Lead Lithium at a velocity of 15 cm/sec. In the test section, samples are mounted in three regions 1) Before magnetic field, 2) within magnetic field, 3) after magnetic field. Temperature is maintained at 550 0 C in the test section. This experiment was carried out for 1000 hours. In the same setup and configuration, another experiment was carried out at higher flow rate, 30 cm/sec, maintaining 5500 C in the test section for a duration of 2700 hours.

The specimens were characterized using analytical tools such as Optical microscopy, Scanning electron microscopy, energy dispersive X- ray (SEM/EDX), EPMA(Electron probe micro analyser). Hardness measurement, tensile strength measurement and fractography would also be carried out on the samples.

This paper presents the preliminary results obtained from the corrosion experiments with IN-RAFMS samples and P-91 samples along with the magnetic effects on corrosion.

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