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Experimental Activities in SCK CEN on Corrosion of Structural Materials in Static and Dynamic Liquid Pb-Bi Eutectic - Overview

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SCK CEN conducts an extensive experimental program within the MYRRHA and SFR-SMR R&D programs to characterize candidate structural materials for their application in heavy liquid metals. Main challenges lie here in the qualification of candidate materials for a variety of environmental parameters of the liquid metal system, i.e.: temperature; flow velocity; liquid metal chemistry with respect to oxygen; alloying and structural state of structural materials; etc. The main aim of the tests is to produce the reliable quantitative data and characterize the candidate steels under conditions representative for HLM reactors, i.e.: 200-400 ℃, Pb-Bi flow velocity of 2 m/s and concentration of oxygen dissolved in the liquid metal around 2×10-7 mass%.
In this presentation we will summarize results from different experimental campaigns carried out in stagnant corrosion installations and in flowing liquid metal using CRAFT loop. Unique results of heavy liquid metal corrosion after very long exposure times (8000+ hours) of a ferritic/martensitic steel (T91) will be discussed. The results show that continuous addition and tight controlling of dissolved oxygen in the liquid metal is a key to successful corrosion mitigation. During the performed long-term exposure under well controlled conditions regarding temperature, flow velocity (2 m/s) and oxygen content in the liquid metal the steel underwent oxidation which resulted in formation of Fe-Cr based oxide films. Localized dissolution corrosion, as a result of local degradation of initially formed oxide film, are characterized as-well. The main results are compared with tests performed under the similar conditions in CORRIDA loop (KIT). Some results on Alumina-Forming Austenitic steels (AFA) and their application as potential structural materials in heavy-liquid metals (Pb, Pb-Bi) will also be briefly discussed.

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