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P2.196 Corrosion resistance of alumina forming steel and ceramic materials in liquid tin

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Liquid tin (Sn) is a promising coolant of liquid divertor systems due to its low vapor pressure. However, the material compatibility with structural materials is an important issue for the development of the liquid divertor system. The purpose of the present study is to explore corrosion resistant materials in the liquid Sn. The corrosion tests were performed in a static Sn at 773K with various types of test samples. The test materials are reduced activation ferritic martensitic steel JLF-1 (Fe-9Cr-2W-0.1C), alumina forming steel (Fe-17.7Cr-3.3Al-0.4Si), pure tungsten (W), pure chromium (Cr) metal, pure titanium (Ti) metal, pure zirconium (Zr) metal, silicon carbide (SiC), silicon nitride (SiN), aluminum nitride (AlN), iron oxide (Fe₂O₃) bulk, alumina (Al₂O₃) bulk and chromium oxide (Cr₂O₃) bulk. Some samples were tested after pre-oxidation treatment in air at 773K. The test duration was 262 hours. After the corrosion tests, the corroded surfaces of the tested samples were metallurgically analyzed by FE-SEM/EDX. The test results indicated that the alumina forming steel revealed a corrosion resistance in the liquid Sn, though the surface was partially corroded by the formation of Fe-Cr-Sn alloy. The ceramic materials also revealed a corrosion resistance in the liquid Sn. The pre-oxidation treatment could be effective to mitigate the corrosion. These results indicated that the material compatibility could be improved by the application of corrosion barriers such as oxide layers and other ceramic coatings.

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