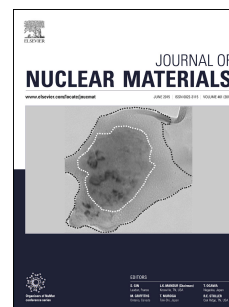


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Molten Salt Corrosion Behaviour of Structural Materials in LiCl-KCl-UCl₃ by Thermogravimetric Study

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Abstract

The corrosion resistance of structural materials has been recognized as a key issue in the various unit operations such as salt purification, electrorefining, cathode processing and injection casting in the pyrochemical reprocessing of spent metallic nuclear fuels. In the present work, the corrosion behaviour of the candidate materials SS410, 2.25Cr-1Mo and 9Cr-1Mo steels was investigated in molten LiCl-KCl-UCl₃ salt by thermogravimetric analysis under inert and reactive atmospheres at 500 and 600 °C, for 6 h duration. Insignificant weight gain in the inert atmosphere and marginal weight gain in the reactive atmosphere were observed at both the temperatures. Chromium depletion rates and formation of Cr-rich corrosion products increased with increasing temperature of exposure in both inert and reactive atmospheres as evidenced by SEM and EDS analysis. The corrosion attack by LiCl-KCl-UCl₃ molten salt, under reactive atmosphere for 6 h duration was more in the case of SS410 than 9Cr-1Mo steel followed by 2.25Cr-1Mo steel at 500 °C and the corrosion attack at 600 °C followed the order: 9Cr-1Mo steel > 2.25Cr-1Mo steel > SS410. Outward diffusion of the minor alloying element, Mo was observed in 9Cr-1Mo and 2.25Cr-1Mo steels at both temperatures under reactive atmosphere. Laser Raman spectral analysis of the molten salt corrosion tested alloys under a reactive atmosphere at 500 and 600 °C for 6 h revealed the formation of unprotected Fe₃O₄ and α- as well as γ-Fe₂O₃. The results of the present study facilitate the selection of structural materials for applications in the corrosive molten salt environment at high temperatures.

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