Materials Exposure Testing in Chloride Molten Salts for Nuclear Applications

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Abstract

Advanced nuclear reactors using alkali chloride molten salts are actively being developed for deployment as safer next generation reactors. These reactors operate more efficiently and can enable a more flexible nuclear fuel cycle. These designs require the development of the understanding of corrosion at operational conditions. Static corrosion studies fail to capture the effects of flowing electrolyte on the corrosion in these systems. To simulate the effects of flow, we have designed and commissioned an apparatus for such corrosion studies. This study explored the corrosion of alloys in LiCl-KCl eutectic molten salt. After long-term exposure under simulated flow conditions, corrosions samples were evaluated using gravimetric analysis, scanning electron microscopy and energy dispersive spectroscopy, Raman spectroscopy, X-ray diffraction, and X-ray photoelectron spectroscopy and the results are compared to corrosion under static conditions. Results and analysis of the effects of fluid flow on the corrosion on structural materials will be presented.

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