

## Material Stability in Molten Salt for Nuclear Power Applications

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Corrosion of materials exposed to molten salts has emerged as a major limitation and concern for several aspects of nuclear science and engineering (1, 2). Specific applications include pyrometallurgical reprocessing of nuclear fuel, and the use of molten salt as the coolant and or fuel carrier for advanced nuclear reactors(3). Due to the complexities of oxidation in these high temperature electrolytes, there is a significant deficiency in the understanding of material stability for these applications.

Material performance was evaluated using polarization behavior, passivity, and post exposure analysis. Potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) are used to study the formation of oxide layers in the molten electrolyte. Post exposure morphological study of the oxide films was accomplished through electron microscopy. Surface chemistry of the oxide films were studied using Raman and X-ray photoelectron spectroscopies (XPS). These independent surface analysis techniques provided an understanding of oxide film formation and preferential material dissociation. Specific electrolytes include various eutectics of LiCl, KCl, LiF, KF, NaF and ZrF. A variety of materials including; austenitic stainless steel 316, Inconel alloys 600, 625, and 718, Hastelloy alloys B, C, N, and X, and pure metals were investigated.

The oxide films formed as a result of exposure and polarization in the molten salt was primarily investigated using XPS. Correlation between surface chemistry and corrosion behavior will be discussed. Specifically the role of Li in material degradation has previously been difficult to study and will also be discussed.

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