

Characterization of properties of the eutectic mixture of zirconium tetrafluoride and potassium fluoride for a molten salt nuclear reactor

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Transitioning to a non-carbon emitting energy source is one of the major challenges that the world currently faces as the impacts of a changing climate becomes more imminent. One of the main suggested sources during our transition to a new energy future will come from nuclear energy. In past decades, the use of uranium fuel rods have been used to generate heat to drive a turbine but in modern society, safer alternatives that have higher efficiency and electrical output are being proposed. Terrestrial Energy is a company based out of Ontario that is developing a pilot plan that uses a eutectic ZrF_4 -KF mixture to be used in a molten salt nuclear reactor. The physical-chemical properties of a eutectic mix of potassium fluoride and zirconium tetrafluoride have been previously untested in a laboratory, but will be the integral mix that will be used in the cooling system in the second loop of the proposed molten salt nuclear reactor. The predictable behavior of the eutectic mix is crucial for the stability and efficiency of such a proposed project. As such, the homogeneity of the mixture, as well as the viscosity, melting and boiling point, solubility, purity, trace impurities of transition metals, and water moisture content within the crystal lattice will be measured. This will be accomplished by examination through laser ablation ionically coupled plasma mass spectrometry (LA ICPMS), X-ray Fluorescence (XRF), and a scanning electron microscope (SEM). The data that will be collected will be submitted to the Nuclear Energy Board of Canada for future projects that will involve these compounds.