

Molten Salt Reactor Fuel: Experiments and Assessments on Metal Fluoride Phase Diagrams

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ABSTRACT

Liquid metal fluoride salts are used as combined fuel and coolant in the Molten Salt Reactor, one of the six Generation IV nuclear reactor designs. In order to assess the properties of potential MSR salts, thermodynamic studies and assessments have been performed at the JRC Institute for Transuranium Elements during the last years.

The experimental work is focussed on the determination of relevant binary and ternary phase diagrams containing compounds like LiF, NaF, CaF₂, ThF₄, CeF₃, (proxy for PuF₃) and UF₃, and on the heat capacity and vapour pressure of the binary liquid phases.

Dedicated experimental tools have been developed for performing these studies. The results are combined with phase diagram assessments using the CALPHAD method. The database thus compiled is used to optimise the fuel composition in view of the relevant properties such as melting temperature, plutonium solubility, and vapour pressure.

In this presentation an overview of the experimental and assessment work will be given.