Molten Salt Chemistry Control

for Fusion Chambers

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The molten salt of Lif-BeF2 is an attractive coolant breeding material for fusion applications. This was the coolant salt used for the molten salt reactor experiment (MSRX). Many engineering issues were studied in the development of the MSRX. One of the key issues for the molten salt is the development a process for chemistry control. Due to the transmutation of Li and Be, the F is the molten salt would be freed to form either free fluorine or hydrogen fluorine. Both F2 and TF can be very corrosive toward the structural materials.

A REDOX process, based on the following chemical reaction, was developed for the MSRE. (REDOX means REDuction and Oxidation, which indicates the chemical state of the molten salt.)

$TF + UF_3 \text{ --à } 0.5T_2 + UF_4$

This process controlled the TF activities successfully. In the fusion chamber, there is no U for this chemistry control process. However, we will have Be in the fusion chamber for neutron multiplication. Since BeF_2 is very stable, we can use the following reaction for the chemistry control,

$2TF + Be \text{ ---à } T_2 + BeF_2$

Based on thermodynamics, this reaction will process toward the left side of the reaction. However, while this reaction will be fast enough to control the chemical state of the molten salt remains to be demonstrated. As a part of JUPITER-II collaboration between us and Japan, an experimental program has been established at INEL to study this process. The results will be available during the earlier part of 2005.