

A Concept of Self-Cooled Breeding Blanket with Advanced Molten Salt FLiNaK for High-Efficiency and Long-Life Operation

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An advanced molten salt (AMS), in which powders of hydrogen-soluble and chemically reactive metals such as titanium are mixed, is investigated as a potential self-cooled breeding blanket material. It is shown that hydrogen isotope uptake in a vanadium plate in molten salt FLiNaK is suppressed by the addition of Ti powders into the salt. In addition, the corrosion of candidate structural materials in FLiNaK with HF is also suppressed by the addition of titanium powders. Considering these results, tritium formed in the molten salt in fusion blanket will be trapped by the Ti powders, not being trapped by the structure materials (vanadium alloy) and not corroding the structure materials. Neutronics and tritium mass balance calculations are also performed and it is shown that FLiNaK based Be-free blanket is feasible.

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