

§6. Reference Calculation of TBR in Flinak

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Molten-salt Flibe is selected as a self-cooling tritium breeder in FFHR from the main reason of safety owing to low tritium inventory, low reactivity with air and water, low pressure operation, and low MHD resistance. Since Flibe has less thermal diffusivity, it is one of key issues to develop innovative concepts for enhancing heat transfer efficiency.

In this study, we calculated tritium breeding ratio (TBR) applying Flinak instead of Flibe. Flinak is composed of LiF, NaF, and KF, and their mol% is 46.5, 11.5, 42, respectively. The melting point of Flinak is 454 degrees centigrade. Needless to say, there is a problem of induced radioactivity in sodium and potassium. Na-24, Ne-23, F-20, and Na-22 are produced from the reaction of neutron and Na-23. K-40, Ar-39, and Cl-36 are produced from the reaction of neutron and K-39. However, Flinak is a better conductor of heat than Flibe because it has low viscosity, high heat transfer efficiency.

The basic structure of blanket and shielding in FFHR is shown in Fig. 1 [1]. We used the 3-dimensional Monte Carlo code MCNP-4B with the ENDF/B-VI data set. The thickness of the second breeding zone, beryllium pebble layer, is varied from 0 cm to 23.9 cm, TBR is calculated on each condition in the infinite cylindrical case shown in Fig. 2. Result of calculation is shown in Fig. 3. In this calculation, the ratio of Li-6 to Li-7 is assumed as natural abundance. TBR increased with increasing the thickness of beryllium pebble layer. Consequently, it can be mentioned that TBR in Flinak is a little smaller than that in Flibe.

Reference

[1] H.Yamanishi et al., Fusion Eng. Des. 41 (1998) 583.

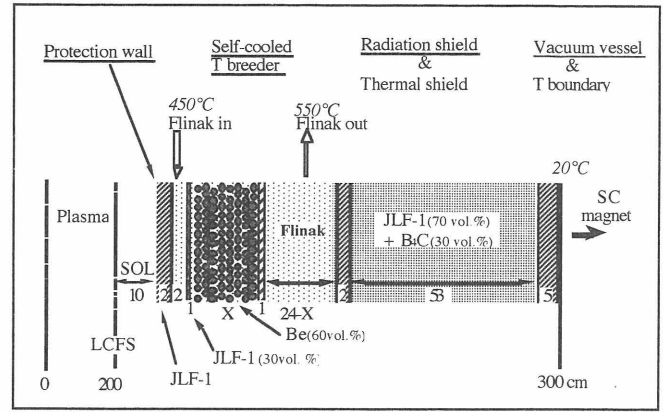


Fig. 1 The blanket and shielding structure in FFHR.

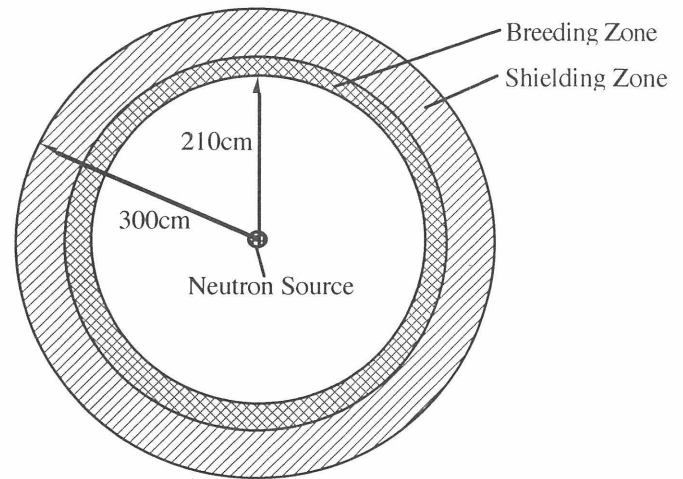


Fig. 2 Cross section of cylinder.

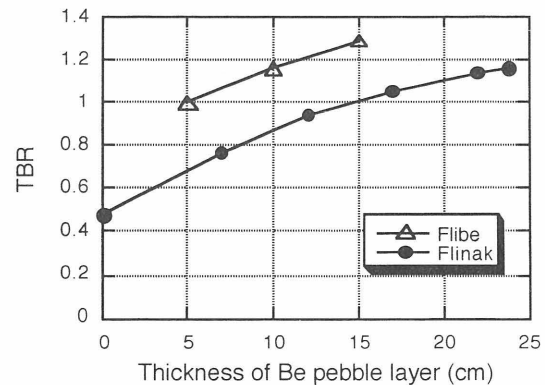


Fig. 3 Variation of TBR with thickness of Be pebble layer.