

Conceptual Design Study of Fusion DEMO Plant at SWIP

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ABSTRACT

The DEMO in China is to demonstrate the safety, reliability and environment feasibility of the fusion power plants, while to demonstrate the prospective economic feasibility of the commercial fusion power plants. Considering that there is still a long way to go towards an economically competitive commercial power plant, DEMO in China should be an indispensable step prior to the commercial one. As one of options, the breeding blanket with ceramic breeders might be basic DEMO concept in the future. The DEMO development strategy, related R&D activities, based on China fusion power plant (FPP) program are presented.

A conceptual design study of fusion DEMO plant based on the helium-cooled/solid breeder/LAFMs (HCSB) concept has been carried out recently. A set plasma core parameters match with DEMO design concept was given. The major parameters of HCSB-DEMO are 2000MW of the fusion power and 2.64 MW/m² of the neutron wall loading. The blanket is designed as modular structure which are consist of 14 sectors along the poloidal direction, and 4×18 sectors on the toroidal direction. The total thickness of inboard blanket is 630 mm and the radial thickness of outboard blanket is 800 mm. The single pebble-bed (38% porosity) of lithium orthosilicate is used as breeder material. The beryllium binary pebble-bed (20% porosity) is used as neutron multiplier material. The coolant pressure and the inlet/outlet temperature in HCSB-DEMO circulation circuit are 8 MPa, 300 °C and 500 °C, respectively. Optimization by changing thickness of breeding zone and enrichment of ceramic lithium-6 has been performed.