Introduction of HL-2M divertor design

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Abstract

HL-2M is a tokamak device that is under construction and put into operation in the near future. The divertor design work of HL-2M carried out at SWIP will be presented. Based on the magnetic coil design of HL-2M, standard divertor, snowflake divertor and tripod divertor configurations are designed. The potential properties of snowflake divertor configurations are analyzed, such as low poloidal field (PF) area around X-point, connection length, magnetic field shear and linear peeling-ballooning (P-B) mode. According to divertor configurations properties of HL-2M, target plates are designed to be compatible with these configurations and to match the requirements of physics and engineering. SOLPS5.0 is used to predict the details of the divertor plasma in these divertor configurations. The constant cross field transport coefficients used in the simulation are estimated according to the heat flux width at outer mid-plane estimated by Eich scaling law. The results show that advanced divertor will dramatically reduce the peak heat flux at outer target by increasing connection length and plasma wetted area. When 10MW heating power flows into the scrape-off layer (SOL) and divertor regions, the peak heat flux at target is less than 2MW/m² with carbon sputter is considered. Owing to the open divertor structure design of HL-2M for advanced divertor operation, it may cause more impurity transports into the core region. From the preliminary divertor design and analysis, HL-2M divertor will satisfy the high performance plasma operation requirements with higher heating power, and will be expected to study advanced divertor physics relevant to next fusion reactor.