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Performance Optimization of ITER and DEMO Plasmas in the Presence of Internal Transport Barrier

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This work investigates performance optimization of ITER and DEMO plasmas in the presence of internal transport barrier. The optimization is carried out using simulation results of BALDUR integrated predictive modelling code. In these simulations, a combination of a neoclassical transport model NCLASS and an anomalous transport model Multimode model is used. The boundary condition is described at the top of the pedestal, which is calculated theoretically based on a combination of magnetic and flow shear stabilization pedestal width scaling and an infinite-n ballooning pressure gradient model. The toroidal flow calculation is based on NTV (neoclassical toroidal viscosity) toroidal velocity model. Time evolution of plasma temperature and density profiles of ITER- and DEMO-like (Japanese and Korean) plasmas are simulated with internal transport barrier (ITB). Several engineering parameters such as plasma current, magnetic field, ion and impurity (Beryllium and Carbon) densities are varied. The aim of this study is to identify the optimization point between plasma performance i.e. central temperature, densities and total fusion power output, and impurity accumulation. Though transport barriers can improve plasma performance, the significant accumulation of impurity in plasma core can lead to an enhancement of radiation loss.

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