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P3.091 Preliminary design of the island divertor coils on J-TEXT tokamak

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The high heat load on divertor target plate is one of the essential issues for future fusion reactors. In stellarator, the island divertor configuration has a long magnetic field line connection length. It is beneficial to increase the equivalent radial transport and the power decay length, and consequently reduce the peaking heat load on the divertor target plate. Therefore, it is significant to explore the possibility of applying this configuration to tokamak. This work uses the external resonant magnetic perturbation (RMP) to generate the boundary magnetic island on J-TEXT, and then studies the feasibility of forming the island divertor configuration on tokamak.

In previous studies of dynamic ergodic divertor (DED) on TEXTOR, it has been observed that magnetic islands and ergodization form at the plasma boundary, which can increase radial transport of particles and distribute the heat flux to a larger area. However, they have found that the 2/1 tearing mode is easily to be excited by the deep penetration of 3/1 base mode. In order to avoid exciting core locked mode, we select the 4/1 island. But higher m and stronger magnetic shear may increase the difficulty to form a large boundary island. To form an island with critical width of about 2.5 cm, the applied 4/1 RMP field needs to exceed 6 Gauss in the edge for the typical boundary plasma parameters on J-TEXT.

Considering to the features of J-TEXT, two types of RMP coils are designed, i.e. the saddle coils outside the vacuum vessel and the S-type modular coils in-vessel. The dominant RMP field produced by these two coils is 4/1 RMP. The width of the 4/1 magnetic island is about 2cm calculated by the NIMROD code. It is consistent with the empirical formula. The detailed design and other researches will be presented in the conference.

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