Edge-plasma analysis for the heat-flux dispersal of the K-DEMO divertor

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The conceptual design study of the Korean fusion demonstration reactor (K-DEMO) has been carried out since 2012 [1]. The fusion power and heating power of K-DEMO are set to 2,200 MW and 600 MW, respectively. 40\% of the heating power radiated to the blanket area was considered. Since the K-DEMO divertor has a double-null type with an up-down symmetry configuration, the remained 60\% of heating power is distributed to the upper and lower divertor was supposed. A detached divertor scenario with impurity seeding was considered as the primary approach for the power exhaust to disperse the peak heat flux lower than the engineering limit of 10 MW/m\textsuperscript{2}. The power exhaust performance at the scrape-off layer was estimated by using UEDGE-2D code a two-dimensional fluid transport code for collisional edge plasma and neutral species [2]. Particle and heat flux on inboard and outboard divertor target was calculated as varying major parameters affecting detachment: the heating power, species of impurity particle (Ne, N, and Ar), the fraction of impurity, the pumping on the private-flux wall. The result shows the heat flux was monotonically increased as increasing the heating power. Ar was the most effective neutral to enhance the radiation and reduce the peak heat flux, although the high-Z impurity seeding tends to degrade the core confinement due to the increased core radiation is a concern. The impact of the pumping of DT gas on the private-flux wall is also an important parameter to lower the electron temperature. However, a very high pumping rate was required to induce the detached divertor.