Advanced Divertor Design and Study: from present EAST/DIII-D to future tokamak device CFETR

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Divertor is one of the key components in Tokamak. The design, construction and operation of advanced divertors have been the main topics of tokamak research during the last decade. In general, developing an advanced divertor configuration requires: (1) Optimizing magnetic configuration to extend the plasma wetted area through flux expansion, and increasing the divertor volume by increasing the field line length; (2) Increasing divertor closure by divertor baffling to improve divertor screening for recycling neutrals and impurities, hence increasing divertor neutral pressure, thus enhancing divertor particle and power exhaust [1,2].

Some advanced divertor solutions have been developed and validated in EAST and DIII-D respectively. In EAST an alternative advanced divertor configuration, i.e., quasi snowflake (QSF), aka X-divertor [3] and in DIII-D an alternative advanced divertor coupling divertor closure with advanced magnetic configuration(X-divertor) [4] have been attempted respectively. The findings clearly indicate that the advanced divertor solutions in EAST and DIII-D can significantly reduce the peak heat flux density at the divertor target and the electron density threshold for detachment, which provides a promising means for the design of advanced divertors in the next step fusion devices.

China has made significant progress in planning for the next device CFETR (China Fusion Engineering Test Reactor) in the roadmap for the realization of fusion energy in China that would bridge the gaps between the fusion experimental reactor ITER and the demonstration reactor DEMO. Construction of the CFETR could start at around 2020 and be followed by construction of a DEMO in the 2030s. Based on the present divertor research in EAST and DIII-D, recently a new initiative has been launched in CFETR to develop and

validate the scientific basis for designing a new advanced divertor so as to evaluate boundary plasma solutions applicable to the next step fusion reactors.

Ref:
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