

Normalized Collisionality scaling of H-mode In the EAST tokamak

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The scaling laws are considered to be a general method for predicting the confinement and transport properties of the next-generation tokamaks [1]. The next-generation tokamaks will operate in a lower collisionality range. Recently, normalized collisionality scaling experiments were performed on the EAST tokamak to understand the plasma characteristics under low collisionality conditions. To scan the normalized collisionality ν^* by varying toroidal magnetic field and ensure that the safety factor q , normalized thermal pressure β and normalized ion Larmor radius ρ^* remain the same. The plasma density is controlled by supersonic molecular beam injection (SMBI) feedback and the temperature is achieved by coordinating the various auxiliary heating powers, in this case only 4.6GHz lower hybrid wave (LHW) and neutral beam injection (NBI). During the EAST tokamak experiments, we obtained two sets of experimental data. The change in the magnetic field goes from 1.58T to 2.07T, and current goes from 0.35MA to 0.55MA. In this work, the differences in β and ρ^* are basically within 10%. Through the regression analysis between the normalized energy confinement time and the normalized collisionality, there is a strong collisionality dependence to the normalized thermal energy confinement time $B_t \tau_E \propto \nu^{*-0.64}$ (the first set) and $B_t \tau_E \propto \nu^{*-0.76}$ (the second set). The scaling results of the two sets are similar, and considering the influence of errors, the scaling results may be directly related to the heating power. The normalized energy confinement time increases as the normalized collisionality decreases, which is consistent with the scaling results of many current devices [2-5]. The next step is to analyze the impact of collisionality on turbulent transport using a turbulence simulation program.

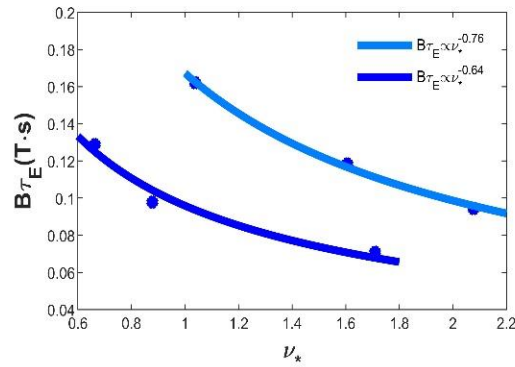


Fig. 2 The relationship between normalized energy confinement time and normalized collisionality in EAST normalized collisionality scaling experiments: the first set (deep blue); the second set (light blue). ν^ are taken at $r/a=0.7$.*

References

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