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Progress of the Recent Experimental Research on the J-TEXT Tokamak

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The progress of experimental research over last two years on the J-TEXT tokamak is reviewed, the most significant results including: the investigation of the effect of resonant magnetic perturbations (RMPs) on the J-TEXT operation region, impurity transport and confinement, and runaway electrons suppression; study of the threshold for runaway current generation; and identification of the quasi-coherent characteristics in spectra of density fluctuations.
The effect of RMPs on the J-TEXT Ohmically heated operation region is studied on J-TEXT by applying RMPs in high density limit and low-q limit discharges. It is found that moderate amplitude of applied RMPs either increases the density limit from less than 0.7nGW to 0.85nGW or lowers edge safety factor qa from 2.15 to nearly 2.0. As a result, the disruption precursor is suppressed and the disruption is delayed by about 30-150 ms.
The influence of RMPs on impurity behavior is also studied by applied RMP with m/n = 2/1 dominant component. It is found that the CV decay time after methane injection decreases as the RMP amplitude increases. When the RMP penetration occurs, the emission of CIII (464.7nm) from the edge region develops a gradually increasing asymmetry. Stronger emission occurs at the high-field-side (HFS) edge.
The potential suppression of runaway electrons by RMP is also investigated on J-TEXT. The experimental result indicates that the magnetic perturbation enhanced the runaway loss rate by the formation magnetic islands rather than by the magnetic perturbation itself. Both the amplitude and the length of runaway current can be reduced by applying the RMP before the disruption.
Regarding the threshold for runaway current generation, it is found that the key parameter affecting runaway generation is the edge safety factor qa, not BT, on J-TEXT. The threshold of qa decreases with increasing BT.
The electrostatic turbulence exhibited quasi-coherent characteristics in the spectra of density fluctuations observed in the J-TEXT ohmic confinement regime. These quasi-coherent modes (QCMs) are detectable in a large plasma region (r/a ˜ 0.3 – 0.8) with frequency of 30 –140 KHz. The mode rotates in the electron diamagnetic direction. The combined experimental results indicate that the QCMs survive in the linear Ohmic confinement regime of the plasma, where the TEM is predicted to be unstable.

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