Tearing mode control with electron cyclotron resonant heating and current drive on EAST tokamak

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The experiments of m/n = 2/1 classical tearing mode suppressed by the ECRH/ECCD have been performed on EAST tokamak. The continuous EC beam with different power is injected perpendicularly into the L-mode plasma and deposited at the radial position of the magnetic island, i.e. ρ = 0.5. It is found that the magnetic island size is reduced gradually as the ECRH power increases from 100 kW to 250 kW, and then it goes to a saturated value (60% of initial size) even if its power increases further, indicating that the classical tearing mode cannot be suppressed completely. This can be explained by the stabilization mechanism which comes only from the temperatures inside the island separatrix. The smaller the island size is, the less the heating area is. The minimum power for the effective stabilization of the tearing mode is 100 kW, which is only about 6% of background plasma. The deposition position of the EC beam is moved from plasma core to edge shot by shot with fixed power of 320 kW. The results shows that the stabilization effect of ECRH/ECCD can be observed in a wide region of ρ = 0.3 - 0.6, however the destabilization effect is enhanced at the plasma core. This can be explained by the fact that the current density profile tailored by ECRH/ECCD changes the magnetic shear and therefore decreases the classical stability index Δ'. It is supposed that the heating rather than the current driver plays an more important role in the des-/stabilization of the 2/1 mode in these low beta discharge. Moreover, the RMP is further applied to control the island rotating slowly, and the stabilization effect of ECRH/ECCD on the island's O and X points with either an inward or outward misalignment allows to be investigated deliberately. The preliminary analysis presents that a good stabilization effect is achieved by ECRH with an inward misalignment of 3 cm relative to the radial location of the magnetic island rather than by ECCD with the almost alignment.