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Experimental study of the H-L power threshold and transition dynamics in EAST under RF heating and carbon (dominant) divertor operation

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The power threshold and dynamic features of the high-low confinement (H-L) transitions with radio frequency (RF) heating and carbon (dominant) divertor operation have been presented in EAST. The power threshold exhibits the same increase with increasing line-averaged electron density with respect to various plasma facing materials (carbon/ molybdenum/ tungsten), while the hysteresis in not visible which is attributed to high radiation losses before the H-L transition. The influence of magnetic geometry on the H-L transition dynamics has been investigated experimentally: the fast or 'single-step' transitions are only obtained for single-null plasmas, and the slow or 'dithering' transitions are frequently obtained for double-null plasmas. The fast H-L transition features a more rapid release of stored energy and a higher perturbation of plasma current after the transition sequence, as compared with dithering transition sequence. Just prior to the fast H-L transition, a gradual increase of the pedestal electron density and decrease of pedestal electron temperature are often observed, meanwhile the mean radial electric field just inside the separatrix decays quickly towards the ion diamagnetic drift direction. On the other hand, a gradual decrease of both the pedestal electron density and pedestal electron temperature are observed during the dithering sequence, meanwhile the mean radial electric field decays slowly with the evolution of a large-scale oscillation axisymmetric flows, as evidenced by reciprocating probe measurement directly. This evolution of pedestal profiles is strongly associated with the edge transport. These findings suggest that the shear flows play an important role in determining the transition physics.