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ELM suppression using resonant magnetic perturbation in EAST

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A big progress has been made in the type-I Edge Localized Mode (ELM) control with Resonant Magnetic Perturbation (RMP) on EAST in 2014 and 2015. A flexible in-vessel RMP coil system has been installed in 2014 for active MHD instabilities control to achieve long pulse steady state operation in the EAST tokamak. It can generate a variety range of spectrum covering most important configurations of the operating coil systems in present tokamaks and the designed one in future ITER. Complete suppression of ELM is observed during the application of n=1 and 2 RMP in EAST, and ELM mitigation is observed for all of the n=1-4 RMP in EAST. The transit peak flux on divertor is reduced during ELM suppression or mitigation. ELM control effect is sensitive to the RMP spectrum used. ELM suppression only happens in a limited resonant window during the scan of the phase difference between the upper and lower RMP coils. Plasma response plays an important role in the ELM control effect. The best spectrum of RMP for ELM suppression is consistent with the MARS-F modeling result.However, the transitions between ELM suppression and ELM mitigation are obviously non-linear. Critical thresholds for the amplitude of the RMP and the plasma rotation for this transition are observed. Clear density pump-out is normally observed during the application of RMP, while magnetic braking effect depends on the plasma rotation.Magnetic braking is observed in the NBI heated relatively high rotation plasma case, while it is not obvious, when the plasma rotation is close to 0 in radio frequency wave dominated heating plasmas. Footprint splitting is also observed during the application of RMP and agrees well with vacuum modelling. The enhancement of transport of the tungsten has also been observed during ELM mitigation.

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