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Recent Advances in Small ELM Regimes: Highlights from EAST Tokamak

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Small Edge Localized Mode (ELM) regimes can maintain the capability of impurity exhaust associated with ELMs while preventing the damage to wall materials that large ELMs can cause. Therefore, they are considered as one of the promising solutions for mitigating transient thermal loads at the edge during high-confinement steady-state operation in fusion devices. Over the past two years, within the framework of the ITPA-PEP joint research and the EAST-ITER collaborative experiments, a significant progress has been achieved in small ELM regime on the EAST device. Firstly, a high-performance small ELM regime with $H_{98,y2}$ up to 1.2 has been successfully achieved with a boronized metal wall, and the operational parameter space of this regime has been explored. Secondly, the characteristic of the power decay length (λ_q) of small ELMs has been systematically studied using a high-resolution infrared camera system. It has been found that the averaged λ_q of small ELMs is broader than that between large ELMs but narrower than within large ELMs. Small ELMs are found to deposit 0.2-0.45 of the ELM power in the far-SOL region. The plasma density could be the key parameters to achieve integrated control of the peak heat flux (q_{peak}), power decay length (λ_q), and heat flux in the far scrape-off layer (q_{farSOL}) in small ELM regime. Thirdly, the compatibility of small ELMs with divertor detachment has been further validated, including the achievement of a long-pulse operation with divertor detachment. ELM burn-through induced by small ELMs has also been investigated.

References

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