Simulations on edge localized modes mitigation with impurity seeding in HL-2A

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Edge Localized modes (ELMs) are repetitive MHD instabilities at the plasma edge that occur in H-mode operation, and could lead to a rapid loss of energy and particles from the plasma edge. It also potentially poses a crucial wall material and divertor erosion risk. Supersonic molecular beam injection (SMBI)[1] and laser blow off (LBO)[2] have been confirmed to be effective ways for ELMs mitigation in experiments. This study mainly combines the integrated framework OMFIT and edge simulation codes such as BOUT++[3] to dive deeper into ELM mitigation mechanisms with impurity injection. Compared with experimental data, characteristics of ELMs before and after impurity injection are presented. Apart from edge radiation, there are two possible mechanisms for ELM mitigation revealed by the simulation results. On the one hand, impurity injection changes the pedestal pressure and current profiles that are closely related to ELM activities. Nonlinear simulation result shows that the reduction of ELM size is due to the change of the pressure and current profiles after impurity injection. On the other hand, the E_r shear changed after impurity seeding will also impact the ELM activities. The simulation results suggest the combination of changes in pressure/current and E_r shear can well determines the change in ELM activities after impurity seeding.

Key words: edge localized mode, ELM control, Er shear, integrated simulation.

References:

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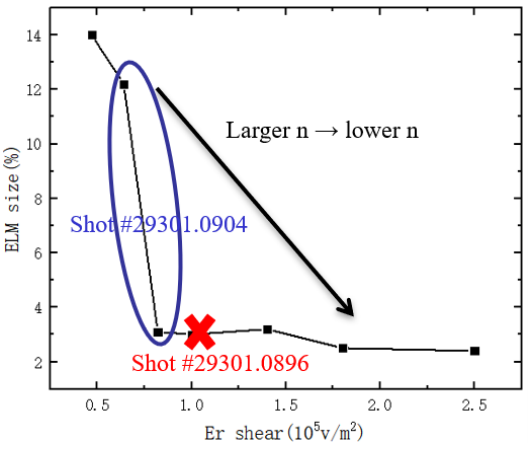

Figure 1. ELM size versus Er shear. Red cross and blue circle represent the Er shear before and after Fe seeding.