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TH/5-3: Reduction of ELM Energy Loss by Pellet Injection for ELM Pacing

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The reduction of ELM energy loss by the pellet injection for ELM pacing has been studied by an integrated core / scrape-off-layer / divertor transport code TOPICS-IB with a MHD stability code and a pellet model. In the ELM pacing, ELMs with the reduced energy loss should be reliably triggered by small pellets to minimize fueling and the impact on the target pedestal plasma. It is found that the energy loss can be reduced by a pellet, which penetrates deeply into the pedestal and triggers high- n ballooning modes with localized eigenfunctions near the pedestal top, where n is the toroidal mode number. This reduction is realized by a small pellet injected from the low-field-side (LFS), while the high-field-side injection triggers lower- n modes with wide eigenfunctions before the pellet penetrates deeply into the pedestal. Early injection on the natural ELM cycle reduces the energy loss because the high magnetic shear prevents the onset of lower- n modes, but leads to the reduction of target pedestal pressure and the enlargement of pellet size to trigger the ELM. On the other hand, the late injection induces the large energy loss comparable to the natural ELM. The LFS pellet injection to the pedestal plasma equivalent to that at the middle timing on the natural ELM cycle is suitable for ELM pacing.

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