Type III ELM suppression using Supersonic Molecular Beam Injection in HL-2A tokamak

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In order to avoid large power loads on the divertor target, one goal is to develop external control tools to reduce the ELM size to acceptable values, while maintaining the confinement properties of the plasma. ITER physics has presented this as a very important topic.

A novel experimental result using flexible SMBI for ELM control has been obtained in the HL-2A tokamak using shallow particle deposition of by Supersonic Molecular Beam Injection (SMBI) in H-mode. The cold particle source position can penetrate the pedestal. The cold particle source position for one SMBI pulse was confirmed using a study of density ratio with time in H-mode plasma. There is a sharp variation around r ~ 37-38cm because of dn_e/dt for shot 13820, where the separatrix postiion is ~ 38.5 cm. It indicates that the main cold particle deposition is inside of the separatrix. The SMBI deposition in H-mode is shallower than that in the Ohmic case.

Fig. 1 shows the experimental results for ELM control using SMBI in HL-2A. The squares (red) mean with SMBI and the circles (blue) mean without SMBI for H-mode discharges. The f_{ELM} with SMBI is larger than that without SMBI. The red dash line and blue dot line are the fit curves for the experimental data, respectively. Here, dot line corresponds to H-mode without SMBI and dash line corresponds to H-mode with SMBI, respectively. Note that the f_{ELM} with SMBI is about two or three times than that without SMBI for I_p ~0.175 MA. The ELM size is reduced correspondingly. A relation between ELM frequency and plasma current is also displayed in fig. 1. A possible explanation of this result is that SMBI deposition in the pedestal inhibits the formation of extended transport events which span the full width of the pedestal.

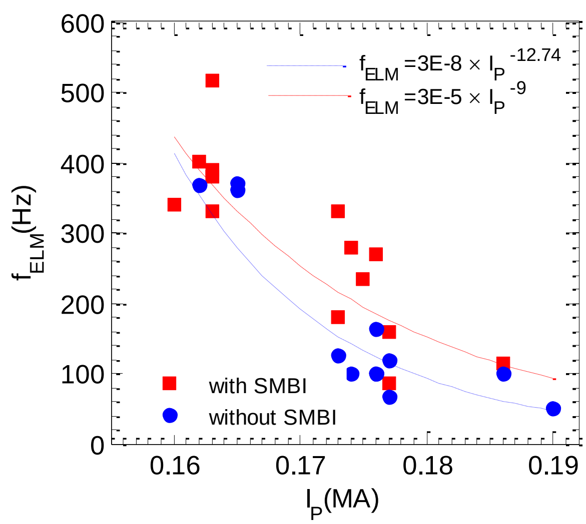

Fig. 1. f_{ELM} w/wo SMBI in H-mode discharges. The squares (red) with SMBI and the circles (blue) without SMBI. Auxiliary heating power is about 0.9-1.2MW and n_l is about 1.8-2.1 × $10^{19}m^{-3}$.