ELM suppression and recycling reduction by BN & B injection in KSTAR

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Long periods of ELM quiescence ≤ 5sec were observed with BN injection into KSTAR ELMy H-modes with an innovative Impurity Powder Dropper (IPD) [1]. In addition, divertor Dα emission was substantially reduced with boron B injection into ELMy H-modes, indicating improved recycling control. In both cases, there was no adverse impact on plasma stored energy. A new mode at ~ 180 kHz frequency appeared in Beam Emission Spectroscopy data, suggesting a modification to the edge transport with active impurity injection.

The powders were dropped into 0.5 MA plasmas with 1.5 MW auxiliary heating and of duration 10-20 s. Photodiode signals and real-color fast camera images show the powders entering the plasma. A series of 2.5 mg doses of BN, delivered in 0.1 s bursts, was observed to eventually reduce the ELM amplitude and frequency without changing the stored energy or plasma density. Analysis of the BES data during the ELM-free phase showed increased coherent mode activity near 180 kHz, corroborated by magnetics data. A continuous BN dose of 2.5 mg/s for 10 s reduced the ELM amplitude and frequency, but did not result in ELM quiescence. In addition, several 2.5 mg doses of B during a single discharge reduced recycling as evidenced by the reduced baseline Dα level during the following shot. A 10 mg dose of B resulted in a disruption. Signatures of each of these effects and the effect on plasma profiles and discharge characteristics will be presented. In addition, these results will be compared with IPDs used for similar experiments on ASDEX-Upgrade [2,3], EAST [4], and DIII-D [5].

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