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Density compensation and stored energy recovery in RMP suppressed-ELM H-mode plasmas using pellet fueling on EAST

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Both pellet injection and external magnetic perturbations (RMPs) are important techniques for fueling and ELM elimination in ITER, respectively. Recently, the fueling of plasmas by frozen pellets in steady-state quiescent H-mode plasmas with edge-localized modes (ELMs) suppressed by (RMPs) was successfully demonstrated on the EAST tokamak in ITER similar shaped plasmas with q_{95} ~ 3.8, and triangularity δ ~0.45. During the fully suppressed-ELM phase using RMPs, the plasmas were refueled by deuterium pellets with a frequency of 5Hz from ~40 cm above mid-plane on low field side (LFS). The results show that the pellet fueling would partially compensate density, which decreased due to the effect of pump-out induced by RMPs. And it is interesting to find that the plasma stored energy would be raised to the value before RMPs application by pellet injection, which is rarely reported in other tokamaks [1-5]. As for ELMs, they reappeared with a size smaller than nature ELMs before RMPs application accompanied with a magnetic coherent mode (MCM) termination, however, ELMs were still mitigated in a certain extent. Meanwhile, similar experiment using SMBI fueling was also carried out, which confirmed that pellet fueling is better to raise the plasma stored energy. This investigation on the synergistic effect of pellet fueling and RMPs would be useful for simultaneous control on plasma density and ELMs in high performance H-mode plasmas in future devices.

Keywords: pellet fueling, ELM suppression, RMPs, EAST tokamak

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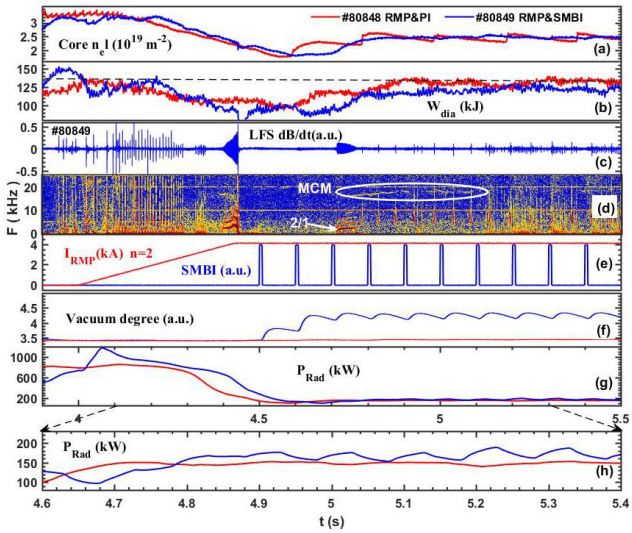

Figure 1 Comparison of pellet and SMBI fueling under RMP application. (a) Central line integrated electron density, (b) diamagnetic plasma stored energy, (c) magnetic fluctuation signal for shot 80849 (blue) and (d) the corresponding time-frequency spectrum, (e) SMBI trigger signal and the RMPs current, (f) vacuum degree of neutral gas, (g) total radiation power, (h) the zoom panel for figure (g)