Impurity experiments in the HL-2A tokamak H-mode plasmas

Abstract:

Impurity control is a key issue in the tokamak. Recent experiments in the HL-2A Tokamak have shown that a quasi-stationary peripheral radiation layer is spontaneously formed with edge peaked impurity profile in the H-mode plasmas. This impurity profile can be self-regulated by the electromagnetic turbulence excited by both positive and negative impurity density gradients with double asymmetrical critical gradients.

ELM control by impurity seeding has been extensively investigated in the HL-2A tokamak with laser blow-off (LBO) and mixture impurity SMBI. Three kinds of metal impurities (Al, Fe, W) were separately injected into the H-mode plasma with LBO, and a mixture of gas including D_2 and light impurity gas (Ne, Ar) was injected by SMBI. Both mitigation and suppression of ELMs have been realized by LBO-seeded impurity. The H-mode plasma confinement was improved with pure impurity SMBI injection. For mixture SMBI impurity seeding, the ELM behavior and plasma confinement varies with the ratio of the impurity gas to D_2. Experiments in HL-2A seem to indicate that there should be an optimal impurity ratio for ELM and divertor heat load control, and suggest that pedestal dynamics and heat loads can be actively controlled by exciting pedestal instabilities and forming a stationary edge radiation layer.