The investigation of ELM-induced W source in EAST divertor

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Abstract—A significant fraction of W sputtering yield is produced by the ELM because the high particle energy during ELM phase [1, 2]. That may introduce unacceptable amount of impurity to plasma and cause damage to the plasma facing component. The ELM control methods like resonant magnetic perturbation (RMP), lower hybrid wave (LHW), pellet injection etc. have been applied in EAST and achieved successful ELM mitigation or suppression. The ITER will operate in type-I H-mode ELM regime in which the ELM must be mitigated or suppressed [3]. So the W sources under controlled ELM condition needed to be investigated. The ELM-induced W source for EAST upper divertor is analyzed including natural and migrated ELM phase in this research. The WI (400.9nm) line radiation is detected by using photomultiplier (PMT) and optical filter. The center wavelength of filter is about 400.8nm and bandwidth is about 1nm. By comparing the W sputtering in inter-ELM and intra-ELM phase, the intra-ELM sputtering is dominate for the whole ELM cycle. The in-out divertor intra-ELM W source asymmetry is also analyzed. The result shows that intra-ELM sputtering is more favored for outer divertor in the $B\times\nabla B\downarrow$ condition. The direction of toriodal magnetic field, plasma current and density can change the in-out divertor intra-ELM W source asymmetry obviously. The W source in ELM control experiment by using RMP and LHW is evaluated. The experimental data indicates RMP field will reduce the ELM induced sputtering reduced, but increase intra-ELM sputtering rate. Both the intra-ELM sputtering and sputtering rate reduced when 2.45 LHW is on. We find that the RMP or LHW changes ELM sputtering rate via changing the ELM frequency. The sputtering rate is closely related to ELM frequency positively. LHW seems has more advantages for control ELM source in the view of material erosion. More specific research of ELM-induced source under RMP and LHW condition will be done in the future.

Keywords—*ELM, Tungsten, RMP, LHW*

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