Laser ablation plasma and its application for elemental analysis

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The Laser Ablation Plasma (LAP) is generated by laser-matter interaction when the laser power density exceeds the ablation threshold of material. The emission spectra of laser ablation plasma have attracted great interest in the scientific community because they allow the study of fundamental aspects such as spatial-temporal evolution of laser ablation plasma, and various applications in many different fields of science such as VUV light source, elemental analysis on the first wall in fusion devices. The online elemental analysis on the plasma-facing components (PFCs) is a crucial issue for magnetic confinement nuclear fusion deceives, such as tokamak and stellarator. Elemental distribution directly reflects the conditions of PFCs and processes of plasma-wall interaction (PWI). The laser-induced breakdown spectroscopy (LIBS) diagnostic technology provides a promising method for wall composition monitoring for nuclear fusion deceives. In recent years, we have developed LIBS for characterization of the co-deposition of impurities, fuel retention, wall conditioning on the first wall in EAST and HL-2A/M tokamaks as well as W7-X stellarator. [1,2] An *in situ* LIBS system in EAST has been built up to provide elemental composition on the first wall since 2014. [3]

Recently, an *in situ* endoscopic laser-induced breakdown spectroscopy diagnostic system (figure 1) for the full tungsten metal upper divertor in EAST has been developed since 2021 experimental campaign. This presents an online elemental distribution on the divertor with various discharge parameters and wall conditions. The results show that the elemental distribution on the W divertor tiles is nonuniform. The fuel ratios (D/(D+H)) in inner target are about 90% which is higher than the ratios in the dome region. The dynamic D content on W divertor decreases after the plasma exposure due to the dominant short retention with outgassing process. The observable high contents of Li and other impurities such as Mo, Cu, etc. are measured on dome region which is corresponding to a deposition-dominated region during the discharges. Both D retention rate and Li deposition rate are higher near the inner target. These works also provide the key technology of wall elemental diagnosis for the future fusion devices. Further details will be presented at the conference.

References
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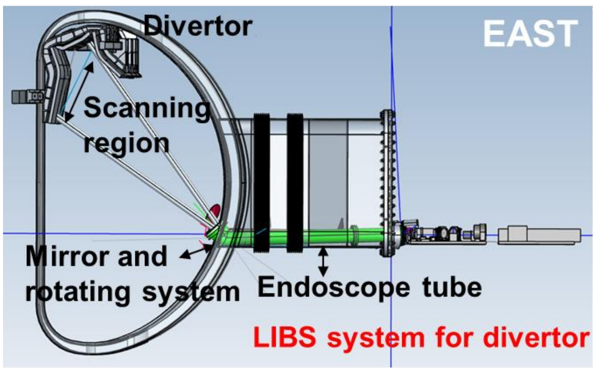

Figure 1 *In situ* endoscopic laser-induced breakdown spectroscopy diagnostic system in EAST