Observation of the whole Thomson scattering spectrum of laser produced plasma for EUV and soft X-ray light sources

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From the viewpoint of applications, plasmas having high density and moderate temperature are attractive tool as Soft X-ray and extreme ultraviolet (EUV) light sources. For example, laser-produced tin (Sn) plasmas are considered as a strong candidate of the light sources for EUV lithography (EUVL), in which EUV light with λ=13.5 nm is used. For practical use of EUVL, the primary challenge involves the improvement of the conversion efficiency of EUV light sources with respect to the output of driving lasers. Measurements and controls of plasma parameters, such as electron density (n_e), electron temperature (T_e), and average ionic charge (Z) are important because the EUV emissivity strongly depends on them. In order to measure these parameters, a collective laser Thomson scattering (LTS) system, which is tuned to observe the ion feature spectra, has been developed by our group [1)]. This system has firstly clarified time-resolved two-dimensional profiles of n_e, T_e, and Z of Sn plasmas [2)]. In this study, $T_i = T_e$ was assumed because the ion feature is not enough to fix the four parameters. The ion feature has only three information, i.e., absolute signal intensity, a width between two peaks and a dip between them. In order to evaluate the four parameters, simultaneous detections of the ion feature and the electron feature are required. Therefore, we have tried to detect both the ion feature and the electron feature of the Thomson scattering spectrum from the plasma which has the parameters of the EUV light source plasmas.

References

1. K. Tomita *et al.*, *Appl. Phys. Express* **8**, 126101 (2015)

2. K. Tomita *et al.*, *Sci. Rep.* **7**, 12328 (2017)

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