Development of a collective Thomson scattering system for high-Z plasmas for Beyond-EUV lithography

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Background

Laser Thomson Scattering (LTS)

In the case of EUV plasma

In the case of high-Z plasma

• Ion term
  • Intensity
  • Spectral width
  • Spectral shape
• Electron term
  • Spectral width
  • Spectral shape

Measure \( n_e, T_e, Z \) from two terms

Expected parameters of the high-Z plasmas

Expected ion term spectra:

- Sn: \( n_e \approx 0.2 \times 10^{23} \text{ m}^{-3}, T_e \approx 30 \text{ eV}, Z \approx 11 \)
- Bi: \( n_e \approx 1 \times 10^{23} \text{ m}^{-3}, T_e \approx 100 \text{ eV}, Z \approx 20 \)

Results and Discussion

Conclusion

For development of the new LTS diagnostic systems for next generation laser-produced light source plasmas, we are planning to observe the ion term and the electron term simultaneously. Considering \( S_e \), clear electron terms are expected only in the range of \( 1 < \alpha < 2.5 \).

By changing the scattering angle, it is possible to control a parameter in 1-2.5 for plasmas parameters, which are expected for laser-produced light sources.

For the preliminary experiment, we measured \( n_e \) and \( T_e \) of laser produce plasmas produced in the air. Now we are trying to diagnose he discharge plasmas.