**Introduction**

The goal of this experiment was to create laser-produced plasmas using Nd:YAG and fiber lasers aimed at tin (Sn) and lithium fluoride (LiF) targets. The plasmas were analyzed both in air and in vacuum utilizing the visible and extreme ultraviolet (EUV) spectrometers.

**CR Model:**

Calculation Power:

\[ P = \frac{E}{t} = \frac{1.1 J}{7.2 \text{ ns}} = 1.5 \times 10^8 \text{ W} \]

Area:

\[ A = \pi (80 \times 10^{-6})^2 = (2.01 \times 10^{-4} \text{m}^2) \times 10^4 = 2.01 \times 10^{-2} \text{cm}^2 \]

Power Density:

\[ \Phi = \frac{P}{A} = 7.46 \times 10^{11} \text{ W/cm}^2 \]

Electron Temperature:

\[ T_e(eV) = (5.2 \times 10^{-6}) \times A^2 \times (\lambda_e^2 \times \Phi)^{1/2} \]

\[ T_e(eV) = 1.79 \times 10^2 \text{ eV} \]

**Methods**

**Equipment:**

- Nd:YAG Laser:
  - Pulse Duration: 180ps
  - Energy: up to 380mJ
  - Wavelength: 1064nm
  - Classification: 4

- Yb Pulsed Fiber Laser:
  - Pulse Duration: 6 ns
  - Power: Up to 31 W
  - Wavelength: up to 1075 nm
  - Classification: 4

- Ocean Optics HR4000 High-Resolution Spectrometer:
  - Focal Length: 101.6 mm
  - Spectral Range: 200-1100 nm

- Jenoptik EUV Spectrometer:
  - Focal Length: 0.25 m
  - Spectral Range: 8 to 18 nm
  - Grating no. 1: 1200 grooves/mm
  - Grating no. 2: 2400 grooves/mm
  - TE cooled CCD Camera: 2048 x 2048 pixels

**Safety**

Required gear for operation:

- Interlocks
- Goggles (for appropriate wavelengths

**Results**

Part I: Acquiring spectra from plasmas at Sn and LiF targets using the Ocean Optics Spectrometer in air and in vacuum — Nd:YAG Laser.

Part II: Acquiring data using Jenoptik EUV Spectrometer in air and in vacuum — Nd:YAG Laser.

Part III: Attempting to acquire data with Ocean Optics Spectrometer — Fibre Laser.

**Figure 1**: (a) Overlay of spectra of plasmas in air formed on Sn (blue) and LiF (red) targets. By comparing the wavelength peak values of each spectrum to existing NIST values, the presence of Sn and H for the Sn target, which accounts for the data being collected in air. The results from the LiF target showed a greater presence of Li ions than Fe ions (b). The second overlay compares spectra of plasmas in vacuum formed on same Sn (black) and LiF (gold) targets. Although the peaks lack the intensity found in the graphs in Figure 1(a), they still show the presence of the respective ions. This discrepancy may be due to a shift in the position of the spectrometer probe during the pumping down of the vacuum chamber.

**Figure 2**: Spectra acquired using the Jenoptik EUV Spectrometer for the (a) Sn and (b) LiF targets.

**References**


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