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Measurement of EUV light in laser-produced plasma generated by a 2um laser on tin droplets

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Extreme ultraviolet (EUV) light is used in the most advanced lithography machines and processes. In these machines, light with a wavelength of $13.5\,\mathrm{nm}$ is transported by a series of multi-layer mirrors to resolve ever smaller chip features. To create EUV light in a band of $2\,\%$ around the desired wavelength, laser-produced plasma (LPP) on tin droplets is used as a source [1]. Our group at the Advanced Research Center for Nanolithography (ARCNL) is doing research on the related plasma processes.

The LPP plasma is produced in the experimental setup of our research group by a high-intensity laser beam with a wavelength of 1 or $2\,\mathrm{\mu m}$. To study the EUV emission properties, plasma emissions are captured by a variety of sensors [2]. As a main goal of the studies is understanding and optimizing the so-called conversion efficiency into EUV light, a set of EUV photodiodes captures the amount of in-band radiation emitted from the plasma. Additional information on the EUV emission is captured by a transmission grating spectrometer and, in the future, an imaging spectrometer. Using spectroscopy additional information on the emission process can be gained, including, for example, the charge states present in the plasma [3].

A second research topic is the study of debris from the plasma, which can be in the form of charged ions, neutral atoms, or droplet fragments. Debris can impact the mirror collecting the EUV light in lithography machines, reducing the lifetime of the optics. The ionic debris is characterized by a set of retarding field analyzers. With this measurement, the energy spectrum and charge distribution of the ions ejected from the plasma can be reconstructed [4].

The experimental setup is used to improve our understanding of the EUV emission process in LPP of tin droplets. The poster presentation will include our methods and results from recent measurements studying LPPs.

References

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