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Broadband spectral characterization of EUV light sources with a transmission grating spectrometer

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Extreme ultraviolet (EUV) lithography light sources are aimed to emit light in a narrow wavelength band (in-band: 13.5 nm ± 1%) that is matching the spectral transmission of the optics and sensitivity of the photoresist. On the other hand, these sources also emit radiation outside the desired wavelength band, extending into the deep ultraviolet (DUV) and visible/IR range. The out-of-band radiation can have significant side effect such as contrast loss in the exposed photoresist or heat load on the delicate optics. Moreover, spectral characteristics of the in-band and out-of-band ranges contain a wealth of information about the conditions of the plasma. A broadband spectral diagnostic can be a vital tool in assessing the side effects of the out-of-band radiation and optimizing the plasma conditions towards higher in-band and lower out-of-band emission. Here we present spectral measurements of an EUV lithography source in the EUV and DUV/visible wavelength ranges using a transmission grating spectrometer. The spectrometer is based on a set of free-standing transmission gratings that can be reconfigured to record EUV and DUV/visible bands without breaking the vacuum. The recorded spectra can be immediately related to specific charge states in the plasma allowing optimization of the source conditions.

Biography

Muharrem Bayraktar earned his BSc degree from Bilkent University in 2007, MSc degree from Sabanci University in 2010 and PhD degree from University of Twente in 2015. His MSc research was on digital holography and interference techniques, and applications of these techniques in three dimensonal imaging and metrology. His PhD research included development of spectral filters and novel adaptive optical components based on piezoelectric thin films for Extreme Ultraviolet (EUV) wavelengths. His postdoctoral research at the University of Twente is on developing a broadband spectrometer for characterization of EUV light sources with a valorization grant awarded by the NanoNextNL programme of Netherlands.