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Measurement of electron temperature and density using Stark broadening of the coaxial focused plasma for extreme ultraviolet (EUV) lithography

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We have generated Ar plasma in dense plasma focus device with coaxial electrodes for extreme ultraviolet (EUV) lithography and investigated an emitted visible light for electro-optical plasma diagnostics. We have applied an input voltage 4.5 kV to the capacitor bank of 1.53 uF and the diode chamber has been filled with Ar gas of pressure 8 mTorr. The inner surface of the cylindrical cathode has been attatched by an acetal insulator. Also, the anode made of tin metal. If we assumed that the focused plasma regions satisfy the local thermodynamic equilibrium (LTE) conditions, the electron temperature and density of the coaxial plasma focus could be obtained by Stark broadening of optical emission spectroscopy (OES). The Lorentzian profile for emission lines of Ar I of 426.629 nm and Ar II of 487.99 nm were measured with a visible monochromator. And the electron density has been estimated by FWHM (Full Width Half Maximum) of its profile. To find the exact value of FWHM, we observed the instrument line broadening of the monochromator with a Hg-Ar reference lamp. The electron temperature has been calculated using the two relative electron density ratios of the Stark profiles. In case of electron density, it has been observed by the Stark broadening method. This experiment result shows the temporal behavior of the electron temperature and density characteristics for the focused plasma. The EUV emission signal whose wavelength is about 6 ~ 16 nm has been detected by using a photo-detector (AXUV-100 Zr/C, IRD). The result compared the electron temperature and density with the temporal EUV signal. The electron density and temperature were observed to be 10^{16} $cm^{-3}$and 20 ~ 30 eV ,respectively.