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Photoelectric current measurement of plasma grid materials for a compact H- ion source

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Low work-function materials have been being studied for the use of plasma grids (PG) of negative hydrogen (H-) ion sources to avoid Cs injection to the sources. In the surface H- ion production process, the low work-function of the surface enlarges the survival probability of H- ions leaving from the surface. The work function of the PG can be measured by photoelectric effect, but small quantum efficiencies of photoelectric effect make detection of electron emission under noisy plasma environment impossible. Semiconductor light sources can generate large photon fluxes; they have the small photon emission area, and the narrow band width of the wavelength spectrum. Thus, we have designed a compact system which exposes the surface of a test PG material with the light from a high-power semi-conductor light source.
The system is composed of a small (60mm diameter, 80mm long) multi-line-cusp ion source and a 3 W light emitting diode (LED) optical system. Light from LEDs of different wavelengths (365nm, 405nm, 470nm, 525nm, 625nm) is focused onto the PG surface using an optical lens. An extraction electrode system behind the PG forms a beam of H- ions produced by in the source. In the first stage, the correlation between the photoelectric current and the H- ion current will be studied for various PG materials, such as Mo, C12A7 electride, and so on. The absolute value of the work function can be also derived by using multiple wavelengths light sources.

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