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# Article / Book Information

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**Discharge Produced Plasma EUV Light Sources for Microlithography and Capillary Discharge SXR Laser**

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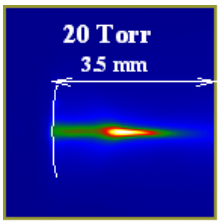
Discharge produced plasma (DPP) extreme ultraviolet (EUV) light sources for microlithography[1)] and a capillary discharge soft X-ray (SXR) laser[2)] are being developed at Tokyo Institute of Technology (Tokyo Tech).

Using a xenon gas jet for EUV emission and a coaxial annular helium gas curtain for debris mitigation, a Z-pinch DPP has successfully demonstrated a potential for an EUV light source. The right figure shows a time integrated photograph taken with an EUV pinhole camera. High EUV emission from a pinched plasma with a length of about 1 mm and a radius of 0.6 mm can be observed.



Photograph taken with an EUV pinhole camera

In order to get higher energy conversion efficiency, a laser-triggered tin (Sn) vacuum DPP is now being investigated. The range of EUV emission depends on laser irradiation energy and the optimum laser energy of several 10s mJ was found. The dependence of EUV emission plasma location on a gap separation length and the laser energy was also found.

Capillary discharge experiments have been carried out to obtain lasing of Ne-like Ar soft X-ray at 46.9 nm using a pulsed power generator, which has the capability of supplying the maximum current of about 35 kA with a half period of 110. Lasing has been successfully observed in a wide range of Ar pressure from 150 to 750 mTorr depending on amplitudes of discharge current. The minimum current for which lasing can be confirmed is 9 kA. The pressure region gradually shifts to higher and becomes wider when the discharge current is increased. Laser outputs twice in a single shot have also been observed, one of which is the electron collision pumped and the other may be attributed to the recombination pumped laser.

REFERENCES

1) S.R.Mohanty, et al., Appl. Phys. Lett., Vol.89, 041502, pp.1-3 (2006)
2) E.Hotta, et al., 28th Int. Conf. on Phenomena in Ionized Gases, WB-2 (2007)