Behaviors of Inductively-Coupled Plasmas Using Low-Inductance Internal Antenna

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Recent trends of flat-panel-display processing toward substrate enlargement and high throughput urgently require meters-scale large-area plasma sources with high plasma density. Furthermore, plasma sources with low plasma potential are strongly desired for high quality processing. To meet these requirements, we have developed inductively-coupled plasma (ICP) sources with low-inductance antenna (LIA) units, which consist of U-shaped antenna conductor covered with dielectric tubing for complete isolation from plasmas. Lowering the inductance of the antenna can attain low-voltage generation of ICPs with high plasma density (1×10^{11}-1×10^{12} cm^{-3}) and low plasma damage (as low as 10 V) [1].

This paper is motivated to investigate discharge structures of ICPs sustained with LIA units in terms of mechanism of plasma generation and potential formation in the regions around the antenna. Figure 1 shows a two-dimensional distribution of floating potential around the powered side of antenna, whose rf conductor was laid in the region of (x, y) = (0, 0)-(-100, 0).

The floating potential tends to increase from less than 4V in the near antenna region to 8V with increasing distance from the antenna. In this presentation, effects of potential structures in the discharge on the properties of plasma will be discussed.

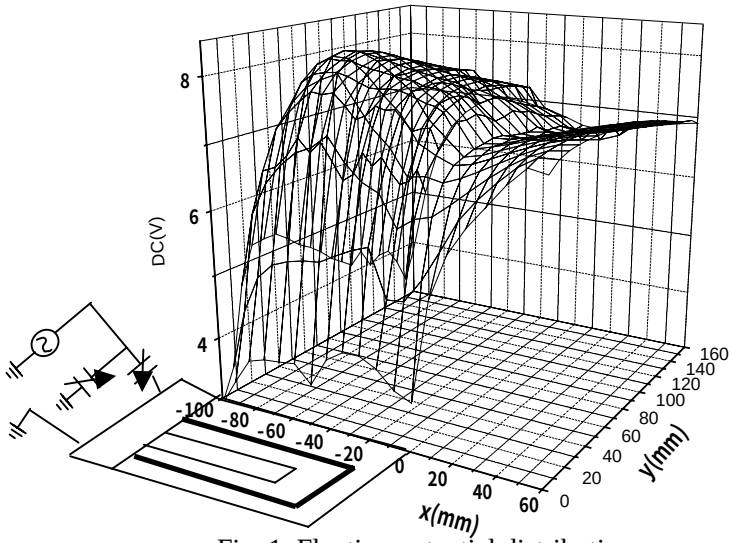

Fig. 1. Floating potential distribution around the antenna

[1] Y. Setsuhara et al., Surf. Coat. Technol. **174-175**, pp. 33-39 (2003).