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## **Hydrophilization treatment of polyimide using Ar-O<sub>2</sub> mixture gas surface wave plasma - Oxygen radical density and plasma parameter dependence**

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Polyimide is used for the flexible printed circuit board. Electroless plating is suitable for making a precise circuit pattern. For that purpose, the hydrophilization treatment on the surface of polyimide is required. The surface wave plasma was adopted for large uniform plasma production. Plasma parameters spatial distribution along a dielectric plate of the surface wave excited plasma is relatively uniform. However, the plasma density decreases rapidly with the distance from the plate because plasma is generated near the plate where the strong surface wave exists. For example, it is important problem to know where the best position for the polymer surface hydrophilic modification is. The surface modification of polyimide has been conducted in the various position and the results were discussed with the measured plasma parameter variation and measured oxygen radical density variation in Ar-O<sub>2</sub> plasma.

Although electron temperature was about 10 eV at the position 1 cm from the dielectric plate, it fell rapidly with the distance from the plate and was 0.5eV at a position 10 cm. On the other hand, although electron density was one 1E11 cm<sup>-3</sup> at a position 1 cm, it fell to 1E8 cm<sup>-3</sup> at a position 15 cm from the dielectric plate. The polyimide sample was put on various positions and hydrophilization treatment was performed. Sufficient treatment was able to be performed in the position distant from the dielectric plate with low electron density. Also in the considerably distant position, measurement of the oxygen radical density measured sufficient density from the dielectric plate. As mentioned above, it turned out that the oxygen radical has played the important role in the hydrophilization treatment of polyimide.

### **Keywords**

Oxygen radical

Surface wave plasma

Catalytic probe

Hydrophilization

Polyimide