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Characteristics of superimposed dual-frequency inductively coupled plasma source

Some of the important specifications for next generation plasma etch systems are the ultra-high etch selectivity and the extremely high uniformity control on the substrate. Especially for inductively coupled plasma (ICP) sources, as the power to the ICP sources is increased for increased plasma density, non-uniform power deposition resulting in non-uniformity of the plasma is increased further. In this study, as one of the methods in controlling the plasma uniformity, superimposed multi-frequency operation on an ICP source has been investigated. When using dual-frequency operation of the ICP source, an improved plasma uniformity could be observed. On the ICP source, dual frequency power (2MHz and 13.56MHz) was applied and, on the substrate, a single frequency (12.56MHz) bias voltage was applied. To examine the role of low frequency source in affecting the uniformity, both single frequency and dual superimposing frequency were compared. It is found that, using superimposed frequency, the plasma distribution and voltage waveform inside the chamber are changed and they affect overall properties of the plasma.

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