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Effect of Multiple Radio-Frequency on Sputter Etching & Ashing in Dual Coil ICP Etcher

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Multiple frequency are widely used in plasma etchers. However, the interactions of multiple RF powers in ICP etcher was not understood clearly. In order to grasp them, SiO_2 sputter etching with Ar was adopted for physical characteristics, and PR ashing with O_2 was adopted for physical & chemical characteristics. Each rate was modeled with ion-limited model. 13.56MHz RF power was applied as source power which was delivered through a dual coil, and 2MHz and 27MHz RF powers were applied as bias powers. We tried to control plasma density with source and 27MHz bias power, and to control ion energy with 2MHz and 27MHz bias power. Plasma density was measured with a non-invasive probe and ion energy was determined from DC self bias. The sum total of bias power was fixed, while 2-27MHz bias power ratio was changed. Ar plasma density was confirmed to be increased by source power, and it was increased with 27MHz bias power when no source power was applied. DC self bias was mainly increased by 2MHz bias power, and it was decreased with increased source or 27MHz bias power. However, DC self bias energy was not sensitive to 2MHz bias power with 600W & 900W source power in SiO_2 etching. Uniformity is controlled by modifying bias power ratio. From the correlation among etching rate(or ashing rate), plasma density and DC self bias, it is estimated that each rate is functions of plasma density and DC self bias.

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Performance analysis of ion beam sources with Laser-Induced Fluorescence

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Laser-induced Fluorescence is a non-perturbing high-resolution method to measure the ion velocity distribution function. We characterized RF ICP ion beam sources via measuring ion beam velocity distributions and energies with LIF. A pulsed tuneable dye laser was used to excite metastable argon ions and the induced fluorescence was amplified by a photomultiplier(PM) tube and sampled by a gated integrator system. Metastable argon ion densities in the argon plasma were measured by the LIF and compared with those of ion beam.