GEC14-2014-020008

Abstract for an Invited Paper
for the GEC14 Meeting of
the American Physical Society

EEDf and IEDf of the non-ambipolar e^--beam plasma and their effects on etch

LEE CHEN, Tokyo Electron America, Inc.

The control of electron shading is crucial in achieving the super-high aspect ratio contact (HARC); precise ion-energy control is essential in the selective etching of lamella diblock copolymers to develop the nano-lines for Direct Self Assembly (DSA). The plasma EEDf not only determines the chemistry but also dictates the shading level of the features. The above processes are presented as examples to illustrate the effects of EEDf and the surgical surface-excitation by a controlled IEDf. In addition to demonstrating the methods of achieving a prescribed IEDf through external bias, the properties of the non-ambipolar electron plasma (NEP) will be presented. NEP is heated by the non-ambipolar beam-current density in the range of 10s Acm^{-2} through beam-plasma instabilities. Its EEDf has a Maxwellian bulk followed by a broad energy-continuum connecting to the most energetic group with energies above the beam-energy and such EEDf seems consistent with that required for deep-contact etching. The remnant of the injected electron-beam power terminates at the NEP end-boundary (i.e., wafer) could set up a controllable DC sheath potential resulting in mono-energetic surface excitation by the charge-neutral plasma beam without the application of external bias.

In collaboration with Zhiying Chen, Tokyo Electron America, Inc., Austin, TX 78741.