

Abstract Submitted
for the GEC06 Meeting of
The American Physical Society

Electron beam-generated ion-ion plasmas: Etching and diagnostics¹ S.G. WALTON, D. LEONHARDT, R.F. FERNSLER, US Naval Research Laboratory — Positive ion-negative ion (ion-ion) plasmas are those where negative ions are the primary negative charge carrier and in the absence of any significant electron density, these negative ions are not confined to the bulk plasma. Thus, a nearly equal and anisotropic flux of positive and negative ions can be delivered to surfaces located adjacent to the plasma and eliminate electron-induced damage to substrates in etching applications. A requirement for the formation of ion-ion plasmas in low pressure, halogen-based gas backgrounds is a low electron energy so that the attachment rate is comparable to the ionization rate and the plasma electrons can be rapidly converted to negative ions. Electron beam-generated plasmas provide an opportunity to investigate ion-ion plasmas and their potential applications because of their uniquely low electron temperature compared to conventional discharges. In this presentation, we discuss recent investigations of ion-ion plasmas formed in pulsed, electron beam-generated plasmas produced in mixtures of SF₆ and their use in silicon etching. In this system, positive and negative ions were extracted using a low frequency (10-50 kHz), low voltage (0-300 V) bias. The results of Si etching experiments and plasma diagnostics will be presented with the goal of understanding the optimum system configuration and operating conditions.

¹This work supported by the Office of Naval Research

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Date submitted: 15 Jun 2006

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