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Low Pressure PECVD of SiO_xN_y Thin Films with Electron-Beam Generated Plasmas[1] DARRIN LEONHARDT, SCOTT WALTON, Naval Research Laboratory — The deposition of thin films of SiO_2/SiO_xN_y is an integral part of flexible displays/electronics, medical implant bio-functionalization, as well as a robust barrier layer ideal for space applications. In all of these applications, such insulating layers must be uniform and defect free over large areas. In this work, modulated electron beam-generated plasmas were used to produce SiO_x/SiO_xN_y films from organic precursors (TEOS or HMDSO) with $Ar/O_2/N_2$ gases. The inherent low electron temperature of these plasmas results in low plasma fields and potentials, which in turn provide low energy (< 3 eV) ions to the substrate. Film properties (electrical, optical and chemical) with respect to gas mixtures, substrate temperature and ion energy will be presented. The incorporation of ion energy during deposition was critical in producing films with lower defect densities than typical deposition processes. Using the ion energy as an additional process control 'knob' the film composition ranged from stoichiometric SiO_2 to heavily hydrolyzed films. The incorporation of additional ion energy showed more dramatic effects at higher than anticipated values ($\sim$50 eV vs. 15 eV). Ion fluxes and energies to the substrate determined by mass spectrometry measurements will be correlated to the process variables, final film composition and recent studies in other plasma sources.

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