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Diagnostics of continuous electron beam-generated plasma for material processing¹ EVGENIYA LOCK², SCOTT WALTON, RICHARD FERNSLER, Plasma Physics Division, Naval Research Laboratory, WASHINGTON, DC 20375 — Electron beam generated plasmas have several unique features that distinguish them from discharges. The latter have electron temperatures in the range of 1-10 eV and a large spread in the electron energy distribution function. The high temperature leads to large plasma potentials and large incident ion energies. The electron beam generated plasma has intrinsically lower electron temperature (< 1 eV), resulting in smaller plasma potentials and in lower incident ion energies. This enables the electron beam generated plasmas to be used in processing of sensitive materials, where excessive ion energies can be problematic. In this work, spatial distributions of electron temperature and plasma density in argon, nitrogen and their mixtures were measured in magnetically confined, continuous electron beam-generated plasmas. The influence of the process parameters including beam energy, magnetic field strength and pressure was analyzed. The only factor that significantly influenced the electron temperature was the gas composition. On the other hand, the plasma density could be adjusted by modifying any of the process variables. Complementary studies on ion energy distributions were performed by Walton, S.G. et al.

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