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Excitation of Ion Acoustic Waves by Electron Beams I.D. KAGANOVICH, Princeton Plasma Physics Laboratory, D. SYDORENKO, University of Alberta, E. TOKLUOGLU, E.A. STARTSEV, A.V. KHRABROV, Princeton Plasma Physics Laboratory, L. CHEN, P. VENTZEK, R. SUNDARARAJAN, Tokyo Electron America, A. RANJAN, K. KUMAR, Tokyo Electron Technology Center America — The interaction of an electron beam with plasma is of particular importance for hybrid DC/RF coupled plasma sources used in plasma processing. A high frequency (HF) electron plasma wave resonant with the high-energy beam may decay into another HF wave and an ion acoustic wave. The new HF wave may have lower phase speed than the original HF wave. Electron acceleration by the slower HF wave may explain the low-energy peak in the electron energy distribution function measured in plasma processing devices [1]. In the present paper, the collisionless electron heating in a hybrid RF-DC plasma source is studied using the particle-in-cell code EDIPIC [2,3]. In simulation, electrons emitted from the cathode surface are accelerated through a dc bias electric field and form an 800 eV electron beam entering the bulk plasma. The beam excites electron plasma waves through the two-stream instability. High localized plasmon pressure creates ion acoustic waves in the process similar to the modulation instability. Eventually, coupling between electron plasma waves and ion acoustic waves deteriorates HF oscillations, which leads to bursting behavior.

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[2] D. Sydorenko, Phys. Plasmas, 14, 013508 (2007)
[3] D. Sydorenko, Phys Rev Lett., 103, 145004 (2009)

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