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Generation of anomalously energetic suprathermal electrons by an electron beam interacting with a nonuniform plasma DMYTRO SYDORENKO, University of Alberta, Edmonton, Alberta T6G 2E1, Canada, IGOR D. KAGANOVICH, Princeton Plasma Physics Laboratory, PETER L.G. VENTZEK, Tokyo Electron America, Austin, Texas 78741, USA — Electrons emitted from electrodes are accelerated by the sheath electric field and become the electron beams penetrating the plasma. The electron beam can interact with the plasma in collisionless manner via two-stream instability and produce suprathermal electrons. In order to understand the mechanism of suprathermal electrons acceleration, a beam-plasma system was simulated using a 1D3V particle-in-cell code EDIPIC. These simulation results show that the acceleration may be caused by the effects related to the plasma nonuniformity. The electron beam excites plasma waves whose wavelength and phase speed gradually decrease towards anode. The short waves near the anode accelerate plasma bulk electrons to suprathermal energies. Rich complexity of beam- plasma interaction phenomena was also observed: intermittency and multiple regimes of two-stream instability in a dc discharge, band structure of the growth rate of the two-stream instability of an electron beam propagating in a bounded plasma, multi-stage acceleration of electrons in a finite system.

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