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Investigation of ion acoustic turbulence in tokamak start-up stage. JIAN CHEN, Princeton Plasma Physics Laboratory, Princeton, NJ, 08543; Department of Engineering Physics, Tsinghua University, Beijing, China, 100084, ALEX KHRABROV, IGOR KAGANOVICH, Princeton Plasma Physics Laboratory, Princeton, NJ, 08543 — Generally, tokamak start-up driven by pure Ohmic heating consists of the gas breakdown, burn-through, and current ramp-up phases. During the current ramp-up stage, plasma has already been fully ionized. The ramp-up is expected due to acceleration of electrons and ions by the induced toroidal electric field. However, the actual rate of current rise may be controlled by an instability triggered by increasing relative velocity between ions and electrons. In this study, we employed an electrostatic particle-in-cell code (1D EDIPIC) to simulate the current ramp-up. Initially (after gas breakdown) electrons and ions are both warm, with assumed Maxwellian distributions in velocity. Periodic boundary condition was adopted for both the particle motion and the electric field. A constant induced electric field was applied in addition to the self-consistent field occurring in the plasma. Simulation results show that ion acoustic instability grows from the initial noise and saturates after several ion plasma periods. The instability could slow down the acceleration of electrons and heat the ions, which can be identified as an anomalous resistivity mechanism. Growth of ion temperature eventually damps the instability. The saturation level of the electrostatic oscillations can be high enough to create phase-space structures known as ion holes, which have been observed in our simulations.

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