GEC14-2014-000021

Abstract for an Invited Paper
for the GEC14 Meeting of
the American Physical Society

Modeling Sheaths in DC Discharges

SCOTT ROBERTSON, University of Colorado - Boulder

Textbook presentations on sheaths are often limited to a discussion of Bohm's criterion because more detailed analysis results in equations that can be solved only by numerical methods. There are both fluid and kinetic models for sheaths that can be solved by packaged numerical integration routines in a mathematical spreadsheet such as Mathematica, Matlab, or Mathcad. The potential profiles and the currents for sheaths at boundaries usually have monotonic profiles that are easily modeled using a Boltzmann distribution for electrons and for ions using the fluid momentum equation and the continuity equation with a source term describing plasma production. Additional ion species and bi-Maxwellian electron distributions are easily included. Virtual cathodes may form above emissive surfaces which divide the distribution function of emitted electrons into a passing population and a reflected population that can be modeled only by a kinetic approach. For sheaths at inserted objects such as probes and dust particles, it is customary to prescribe the plasma characteristics at infinity, to ignore creation of new plasma by ionization, and to solve for the radial variation of the density near the object and for the current collected by the object. A kinetic model is required for sheaths at inserted objects because the distribution function must be divided into passing particles and collected particles.