Potential formation in front of a floating, planar, electron emitting electrode studied by particle in cell simulations

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The study of electron emitting surfaces is of great importance for plasma physics. Understanding the potential formation in front of an electron emitting solid surface in contact with a plasma is important for various applications – from emissive probes to implications in the field of fusion. For instance the divertor in ITER is expected to reach such high temperatures that it could become strongly emissive [1].

In this work potential formation in front of a planar, floating, electron emitting electrode is investigated using a 1d3v particle in cell code BIT1 [2]. Plasma is created by volume ionization in the entire space between two planar electrodes. The right electrode is at zero (reference) potential, while the left electrode is floating and emits electrons. It is assumed that the flux of emitted electrons is a given quantity. This corresponds to Richardson emission from a hot metal electrode. The distribution function of the emitted electrons is assumed to be a drifting Maxwellian. Effects of drift velocity, temperature and flux of emitted electrons on the potential profile are studied. As those three parameters are varied transitions between monotonic, space charge limited and inverted sheath [3] are observed. The drift velocity of emitted electrons turns out to be a rather important parameter.

References

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