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Influence of secondary electron emission on plasma-surface interactions in the Geostationary orbit environment

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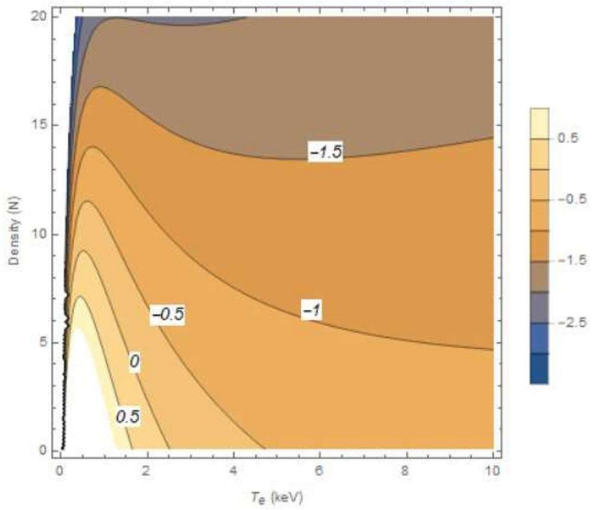
Abstract

Secondary electron emission is a material property that plays a crucial role in surface charging. Secondary electron yield δ(E) at normal incidence of primary electrons is frequently modelled by well known semi-empirical laws. Theory of surface charging has revealed the relationship between the secondary electron emission and surface potential. This study focuses on the charging threshold and potential jump criteria on a probe surface, specifically by incorporating both electron- and ion-induced secondary electron emission; the latter being a factor often overlooked in many existing charging models. We derive the current balance equation to reveal the threshold conditions in both Maxwellian and nonextensive plasmas using various yield models. The impact of the nonextensive q-parameter, secondary electron emission (SEE) currents, and the ion-to-electron density ratio on the charging threshold is thoroughly examined. The threshold condition on material surfaces, incorporating ion-induced SEE currents, predicts a significant modification in the overall charging phenomenon. The numerical analysis is carried out for several space grade materials (high Z and low Z) at GEO altitudes.



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