The effects of asymmetric secondary electron emission induced by different materials electrodes in capacitively coupled plasmas

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The effects of asymmetric secondary electron emission (SEE)induced by different materials electrode has been investigated by performing aParticle-In-Cell /Monte Carlo (PIC/MCC) simulation in capacitively coupledargon plasmas, sustained at various pressures and voltage amplitudes. Todescribe the electron-surfaces interaction, a realistic model, considering theenergy and angle of initial incident electrons and the corresponding emissioncoefficients based on surfaces properties, is employed. There are three typesof interactions between electrons and dielectric surfaces: (i) elasticallyreflected electrons process; (ii) inelasticallybackscattered electrons process and (iii) electron induced SEEprocess. The corresponding emission coefficients are determined as a functionof energy and angle of incident electrons, taking account into the propertiesof the electrode surfaces. Differently, process (i) and (ii) are absent for themetal surface. We assume that the electrode materials is copper (Cu) for all cases,and the driving electrode materials is Cu or silicon dioxide (SiO2) forpractical application. The simulation results reveal that the electron inducedSEE has a strong influence on plasma density and ionization dynamics under highvoltage amplitude and low pressure condition. A complex dynamics effect ispresented due to the multiple electron-surface interaction processes andasymmetric electrode materials. Therefore, it is necessary to further explorethe effects of electron induced SEE.

This work is financially supported by the National NaturalScience Foundation of China (NSFC) (Grant No. 11335004, 11722541, and 11675039)and the Important National Science and Technology Specific Project (Grant No.2011ZX02403-001).