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Effect of surface protrusion on plasma sheath properties in DC microdischarges.[1] YANGYANG FU, PENG ZHANG, JOHN VERBONCOEUR, ANDREW CHRISTLIEB, Michigan State University, PLASMA THEORY AND SIMULATION GROUP TEAM — The electric field enhancement due to the presence of cathode surface protrusion is investigated in the atmospheric DC microdischarges with the goal of identifying the plasma sheath properties. The electric field enhancement of a semi-ellipsoidal protrusion is examined by adjusting the semi-major axis, a, and the semi-minor axis,b, of the ellipsoid. It is found that the cathode electric field enhancement depends strongly (weakly) on the aspect ratio (size) of the protrusion, when it is much smaller than the discharge gap distance. In particular, when the protrusion is spherical ($a = b$), the cathode electric field enhancement in vacuum, as well as inside the plasma, are found to be almost constant against the radius of the hemispherical protrusion. The corresponding plasma sheath thickness is also nearly a constant with different radius. When the protrusion is ellipsoidal ($a \neq b$), the electric field enhancement decreases and the sheath thickness increases, when the semi-minor axis b increases. However, the ratio of the cathode electric field in vacuum to that in the steady-state plasma is found to be nearly a constant. The results indicate that effects of surface protrusions on plasma sheath properties are correlated with their vacuum electric field distributions.

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