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Electric field profiles in obstructed helium discharge PETER FENDEL, Thorlabs, BISWA GANGULY, PETER BLETZINGER, Air Force Research Laboratory — Axial and radial variations of electric field have been measured in dielectric shielded 25 mm diameter parallel plate electrode for 2 mA, 2250 V helium dc discharge at 1.75 Torr with 6.5 mm gap. The axial and radial electric field profiles have been measured from the polarization dependent Stark splitting of $2^1S \rightarrow 11\ ^1P$ transition through collision induced fluorescence from $4^3D \rightarrow 2^3P$. The electric field values showed a strong radial variation peaking up to 5 kV/cm near the cathode radial boundary, and decreasing to about 1 kV/cm near the anode, suggesting the formation of an obstructed discharge for this low Pd condition. Also, the on-axis electric field was nearly constant across the gap indicating a radially non-uniform current density. In order to obtain information about the space charge distribution in this obstructed discharge, it was modeled using the 2-d axisymmetric Poisson solver with COMSOL finite element modeling program. The model discharge dimensions were selected to match the experimental dimensions. The best fit to the measured electric field distribution was obtained with a space charge variation of $\rho(r) = \rho_0(r/r_0)^3$, where $\rho(r)$ is the local space charge density, ρ_0 is the maximum space-charge density, r the local radial value and r_0 the radius of the electrode.

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