ICRF Breakdown Studies *

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One of the challenges of ICRF operation in tokamak plasmas is reliable operation at high voltages. On Alcator C-Mod, we observe arcing among ICRF antenna components at electric fields of 1.5 MV/m for $E_{RF}||B$. Electrical breakdown is influenced by the antenna material, neutral pressure, ionizing radiation, and the tokamak magnetic field. While copper is typically utilized due to its superior conductivity, it has a relatively low melting temperature (1085 C), low tensile strength, low breakdown field (170 MV/m), and strong material displacement after breakdown. The low melting temperature and tensile strength lead to a reduced voltage breakdown limit. The material displacement after breakdown is consistent with observations that the antenna voltage limits degrade with operation. Due to high tensile strength and melting temperature, refractory metals could improve voltage limits[1-3]. A test stand has been designed and built to characterize ICRF relevant voltage breakdown. The vacuum test stand structure is a double-ridged, tapered waveguide which creates a peaked electric field of 7.5 MV/m at the electrode location. Effects of electrode material, surface structure, magnetic field and neutral pressure are investigated. Results will be presented.

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