

Abstract Submitted
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Apparatus and Method to Plasma Etch Inner Surface of the Varied Diameter Cylindrical Structure JANARDAN UPADHYAY, DO IM, J. PESHLE, S. POPOVIC, Old Dominion University, ANNE-MARIE VALENTE-FELICIANO, L. PHILLIPS, Thomas Jefferson National Accelerator Facility, L. VUSKOVIC, Old Dominion University — Plasma processing of inner surfaces of cylindrical structures imposes a coaxial method of discharge generation. It is exemplified with a superconducting radio-frequency cavity made of Niobium, which is a cylindrical structure with variable diameter. It was etched using the coaxial RF discharge operated at 13.56 MHz in Ar/Cl₂ mixture. The cavity is tested on RF performance before and after the plasma etching and the test results are presented. In the coaxial approach one is faced with the development of a negative self-bias potential on the inner electrode in coaxial plasma, which makes processing of outer wall difficult. The processing of the cylindrical structure with varied diameter has two unique problems of having the variation in plasma sheath asymmetry and the extreme loading effect due to depletion of radical density along the gas flow direction. To overcome these problems, the shape of inner electrode is optimized for asymmetry reduction and a corrugated structure pattern is chosen. Further, a segmented plasma processing method is chosen that includes relative motion of the gas inlet and inner electrode. The coaxial cylindrical discharge was characterized with the help of optical emission spectroscopy and the correlation between plasma parameters and etching rates is presented and discussed.

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