

Abstract Submitted
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Uniform Plasma Etching of Complex Shaped Three Dimensional Niobium Structures for Particle Accelerators¹ JANARDAN UPADHYAY, DO IM, JEREMY PESHLE, SVETOZAR POPOVIC, LEPSHA VUSKOVIC, Old Dominion University, LARRY PHILLIPS, ANNE-MARIE VALENTE-FELLICIANO, Jefferson Lab — Complex shaped three dimensional niobium structures are used in particle accelerators as super conducting radio frequency (SRF) cavities. The inner surfaces of these structures have to be chemically etched for better performance, as SRF performance parameters are very sensitive to their properties. Plasma etching of inner surface of three dimensional niobium structures has not been reported even though plasma etching of niobium has been reported earlier for Josephson junction and other applications. We are proposing an RF capacitively coupled coaxial (ccp) plasma etching method for nano machining of niobium structures for SRF applications. We are using gas mixture of Argon and Chlorine. We report the effects of the pressure, RF power, gas concentration, shape and size of the inner electrode, temperature of the structure, DC bias voltage and residence time on the etch rate of the niobium. We also show the method to reduce the asymmetry effect in coaxial ccp by changing the shape of the inner electrode in cylindrical structure, as well as a method to overcome the severe loading effect in etching of 3D structures for uniform mass removal purpose.

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