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Mechanism of Niobium Etching in Ar/Cl<sub>2</sub> Microwave Discharge<sup>1</sup> J. UPADHYAY, M. RASKOVIC, S. POPOVIC, L. VUSKOVIC, Department of Physics, Old Dominion University, L. PHILLIPS, A.-M. VALENTE-FELICIANO, Thomas Jefferson National Accelerator Facility — Plasma based Nb surface treatment provides an excellent opportunity to eliminate surface imperfections [1] and increase cavity quality factor in important applications such as particle accelerators and cavity QED, as well as Josephson junctions [2]. We used a microwave glow discharge in Ar/Cl<sub>2</sub> mixture to remove impurities and mechanical damages from the surface of bulk niobium samples. The high etching rates, in the order of 1  $\mu$ m/min were obtained using a less than 3%Vol concentration of Cl<sub>2</sub> gas. The etching rate dependence on discharge parameters such input power density, pressure and  $Cl_2$ concentration was determined. Simultaneously, plasma emission actinometry was used to estimate the absolute densities of Cl,  $Cl^+$  and  $Cl_2$  in the variable plasma conditions. This results, combined with results of discharge diagnostics, were used to determine the plasma etching mechanism. [1] M. Raskovic, et al., Nuclear Instruments and Methods in Physics Research A 569 663–670 (2006). [2] S. Gleyzes, et al., Nature 446, 297 (2007).

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