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**Etching rate and surface roughness of niobium samples and plasma properties of $Ar/Cl_2$ discharge in a SRF cavity.** JANARDAN UPADHAY, SVETOZAR POPOVIC, LEPOSAVA VUSKOVIC, Old Dominion University, Department of Physics, Center for Accelerator Science, Norfolk, VA 23529, ANNE-MARIE VALENTE, LARRY PHILLIPS, Thomas Jefferson National Accelerator Facility, Newport News, VA 23606 — Plasma based surface modification is a promising alternative to wet etching of superconducting radio frequency (SRF) cavities. The crucial aspect of the technology development is dependence of the etching rate and surface roughness on the frequency of the power supply, pressure and power level during plasma processing. To optimize the plasma parameters, we are using a single cell cavity with 20 sample holders symmetrically distributed over the cell. These holders serve the purpose of diagnostic ports for the measurement of the plasma parameters and for the holding of the Nb sample to be etched. Plasma is generated in the asymmetric radiofrequency discharge between coaxial driven electrode and grounded cavity shell. The plasma properties at RF (100 MHz) and MW (2.45 GHz) frequencies are being measured with the help of electrical and optical probes at different pressures and RF power levels inside of this cavity. The niobium coupons placed on several holders around the cell are being etched simultaneously. We present the study of correlation between the measured local plasma properties and the etching rate/surface roughness.

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