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HF-Free Bipolar Pulsed Electropolishing of SRF Cavities[1] HANNAH HU, Cornell University, HUI TIAN, Thomas Jefferson National Accelerator Facility, OLGA TROFIMOVA, Thomas Jefferson National Accelerator Facility, The College of William & Mary — Surface roughness is one of the factors limiting the performance of superconducting radio frequency (SRF) accelerator cavities. Bipolar Pulsed Electropolishing (BPEP) is a surface processing treatment that uses anodic and cathodic pulses. BPEP uses a HF-free electrolyte, thus reducing the costs and hazards associated with HF while still yielding a comparable surface finish to that of traditional etching techniques. This project focuses on understanding how polishing parameters affect the etching processes of Nb as well as conducting initial testing on N_2 doped and Nb_3Sn samples. Nb samples were polished at varying anodic voltage and pulse repetition frequencies (PRF); N_2 doped and Nb_3Sn samples were repeatedly etched with 1 μm and 200 nm removal respectively. Before and after each treatment, samples were studied under an Atomic Force Microscope and Scanning Electron Microscope for surface roughness and morphology. For Nb, etch rate stays constant with anodic voltage and is directly proportional to PRF. For Nb_3Sn, BPEP selectively etches Nb, changing the chemical composition of Nb_3Sn. Understanding the effects of these polishing parameters enables us to apply BPEP more efficiently to single and multi-cell Nb, N_2 doped, and Nb_3Sn SRF cavities.

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