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Effect of Temperature on Niobium Surface Morphology during Buffered Electropolishing JENNIFER BEVERIDGE, Indiana University of Pennsylvania, ANDY WU, Thomas Jefferson National Accelerator Facility — To achieve high acceleration gradients for particle accelerators based on niobium (Nb) superconducting radiofrequency (SRF) technology, Nb cavity surfaces must be as smooth and as free from imperfections as possible. Presently, removing the imperfect Nb surface layer is performed by buffered chemical polishing (BCP) or electropolishing (EP). Buffered electropolishing (BEP), a method developed at Jefferson Laboratory, has been shown to outperform both BCP and EP in terms of surface smoothness and polishing rate. BEP utilizes HF, H_2SO_4, and lactic acid to etch away the damaged Nb surface layer. The mechanism for the Nb removal from the surface was studied, as well as how the Nb surface morphology changed with temperature. BEP was performed on Nb at temperatures between 7 $^\circ$C and 44 $^\circ$C and the surface smoothness was evaluated. To investigate the role of lactic acid in BEP, soluble Nb complexes with lactic acid were proposed and an electrolyte consisting of H_2SO_4 and lactic acid was used to electropolish Nb. Results indicate that higher temperature during BEP yields faster polishing rates, maximizing near 32 $^\circ$C, and that a smoother Nb surface can be obtained by polishing between 21 $^\circ$C and 32 $^\circ$C. In addition, results suggest lactic acid may form soluble coordination compounds with niobium, aiding HF in Nb removal from the material surface.

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