February 14, 2020

Reduction of Calibration Uncertainty of Nitrogen Doped Niobium

Author(s): Jonathan Angle[1], Ari Palczewski[2], Charlie Reece[2], Fred Stevie[3], Michael Kelley[1,2]

[1]Virginia Polytechnic Institute and State University, Blacksburg, VA, USA

[2]Thomas Jefferson National Accelerator Facility, Newport News, VA, USA

[3]Analytical Instrumentation Facility, North Carolina State University, Raleigh, NC, USA

Abstract

Accurate analysis via secondary ion mass spectroscopy (SIMS) of N-Doped Niobium is challenging. Consequently, in the field of Radiofrequency Superconductivity (SRF), SIMS results are commonly estimated as a relative concentration. Determining the concentration of nitrogen within a niobium matrix requires the use of an implantation standard to convert the signal intensity to concentration (ppma) by use of a correction factor called the relative sensitivity factor (RSF). Consistent RSF determination is crucial as improper determination of this value may cause a cascading effect leading to inaccurate data collection of cavity samples. Several factors can influence the RSF. Therefore, in this study we show factors which effect the RSF, and postulate methods to improve data collection.

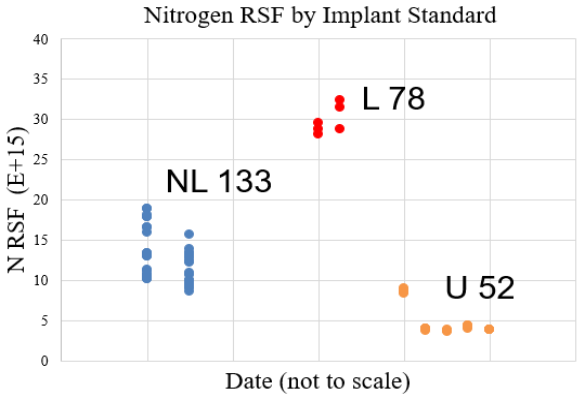

Fig 1: Evolution of RSF Uncertainty with new iterations of Implant Standards.

Biography

Jonathan is a Ph.D. Student studying under Dr. Kelley and Dr. Reynolds. Jonathan graduated from Radford University with a B.S. in Chemistry in 2009. He later worked as the microscopy manager at Polymer Solutions Incorporated where he specialized in various characterization techniques. He later returned to graduate school in 2016 where he received his M.S in Materials Science and Engineering in 2018. Currently Jonathan is developing methodology to characterize baking conditions of superconducting radio frequency cavities such as those used at the LCLS II Particle Accelerator at Stanford. His work was recently reported at the 19th International Conference of Radiofrequency Superconductors and the Tesla Technology Collaboration at CERN.