



Managed by Fermi Research Alliance, LLC for the U.S. Department of Energy Office of Science

Vertical Testing of Eco-Friendly Bipolar Electromechanical Bulk Processing of SRF Cavities

Cooperative Research and Development Agreement Final Report

CRADA Number: FRA-2014-0012

Fermilab Technical Contact: Allan Rowe

Summary Report
29 November 2016

NOTICE

This report was prepared as an account of work sponsored by an agency of the United States government. Neither the United States government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or any agency thereof.

Available electronically at <http://www.osti.gov/bridge>

Available for a processing fee to U.S. Department of Energy and its contractors, in paper, from:
U.S. Department of Energy Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831-0062
phone: 865.576.8401
fax: 865.576.5728
email: <mailto:reports@adonis.osti.gov>

Available for sale to the public, in paper, from:
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
phone: 800.553.6847
fax: 703.605.6900
email: orders@ntis.fedworld.gov
online ordering: <http://www.ntis.gov/ordering.htm>

In accordance with Requirements set forth in Article X of the CRAD, this document is the final CRADA report, including a list of Subject Inventions, to be forwarded to the Office of Science and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

CRADA number: FRA-2014-0012

CRADA Title: Vertical Testing of Eco-Friendly Bipolar Electromechanical Bulk Processing of SRF Cavities

Parties to the Agreement: Faraday Technology, Inc. and Fermi Research Alliance, LLC

Abstract of CRADA work:

Fermilab will provide a single-cell 1.3 GHz RF cavity and niobium coupons for Faraday Technology to use to develop the bulk bi-polar electropolishing process. The RF cavity will remain Fermilab property. Phase I will first demonstrate the feasibility of the process on coupons to optimize Bipolar EP process parameters to achieve niobium removal rates that are compatible with bulk processing throughput rates, while maintaining desired surface finishes. Subsequently in Phase I, we will transition the Bipolar EP process from coupons to bulk processing of single-cell cavities, while maintaining the desired removal rates. The project team will determine the performance effect of the Bipolar EP Bulk Process via cavity testing, and develop a preliminary economic analysis showing the commercial viability of the technology as compared to conventional practice.

Under this CRADA, Fermilab provided a 1.3 GHz RF cavity to Faraday Technology to use for acid-free electropolishing studies. The original scope of work provided for up to two tests of the electropolished cavity in Fermilab's Vertical Test Stand (VTS).

Summary of Research Results:

The average Nb thickness removed from the cavity was measured by Fermilab as ~51 μm , considered sufficient to demonstrate the efficacy of the technology. The beam tubes had a higher removal rate than the equator; as is commonly observed in convention sulfuric/hydrofluoric acid EP. Fermilab tested the cavity prior to hydrogen bake out and it exhibited Q disease. Upon baking/ reprocessing, cavity performance was recovered. Due to time constraints, only one testing cycle was completed.

Related Reports, Publications, and Presentations:

Paper MOPB101 from the Proceedings of SRF2015, Whistler, BC, Canada entitled:
ELECTROPOLISHING OF NIOBIUM SRF CAVITIES IN ECO-FRIENDLY AQUEOUS
ELECTROLYTES WITHOUT HYDROFLUORIC ACID, M. Inman et al

Subject Inventions listing:

None

Report Date: 11/29/2016

Technical Contact at Fermilab: Allan Rowe

This document contains NO confidential, protectable or proprietary information.