

Cornell Laboratory for Accelerator-based Sciences and Education (CLASSE)

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ADVANCED VERTICAL ELECTRO-POLISHING STUDIES AT CORNELL WITH FARADAY TECHNOLOGY, INC. MOPLR047

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Introduction

Cornell's SRF group and Faraday Technology Inc. have started collaborations on two phase-II SBIR projects. Both projects are aiming for the development of advanced Vertical Electro-Polishing (VEP) for Nb SRF cavities, such as HF free or acid free VEP protocols. These could be eco-friendlier alternatives for the standard, HF-based EP electrolyte used, and could bring new breakthrough performance for Nb SRF cavities. Here we give a status update and report first results from these two projects.

Cornell's Vertical Electro-Polishing (VEP)







Typical EP parameter for single cell: EP voltage=DC 12V, Ave.current = 20A. No acid circulation during EP process.

Faraday's Bipolar Electro-Polishing (BEP)



Cavity Polishing Waveform Details for 5% H₂SO₄ electrolyte 4 V anodic for 200 ms, off 300 ms, -10V cathodic for 200 ms *parametric study is on going at Faraday



1.0E+11







4. VT #3

HPR

Equator weld seam on RF surface post 120um VEP



The first breakthrough result by Vertical EP; Achievement of 40MV/m with VEP'ed 9-cell at Cornell.

6. Short probe 7. VT#4 VT#4 VT#3 had an abnormal cool-down 32 MV/m -accidental 100 K hold 2hrs Q_=1.1E+10 -warm up to 220 K -guick cooldown to 2 K VT#4 may suffer from some residual hydrogen since no 800C bake but had >100 um EP. Gradient (MV/m Achievement of 44MV/m with BEP'ed 1-cell at

FNAL. Bipolar EP was done by Faraday.

Two SBIR-II projects are in progress between Cornell and Faraday

1) 9-cell scale Bipolar EP w/5% H_2SO_4 electrolyte.

Upgrade Bipolar EP system into 9-cell scale at Faraday.

BEP system upgrading is almost completed.

Demonstrate 9-cell scale BEP using three 1-cell cavities at Faraday.

Planed this winter.

- Cavity fabrication and RF test at Cornell.
 - Cavity fabrication was completed

2) Acid-free Bipolar EP of Nb SRF cavities.

- Feasibility study of BEP with near-neutral, aqueous, acid-free salt electrolytes.
 - R&D using Nb coupon is in progress at Faraday.
 - Half-cell coupon cavity is available for actual cavity scale investigation.
- Initiate BEP trials with salt-based electrolyte on 1-cell cavity.
 - Acid-free BEP trial on 1-cell cavity will be done soon at Faraday.
 - RF test is planed at Cornell early 2017.

Nb Pulse Reverse Electropolishing in KCl and Water

Baseline RF test post VEP planed this October.

RF test post 9-cell scale BEP planed early 2017.









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