

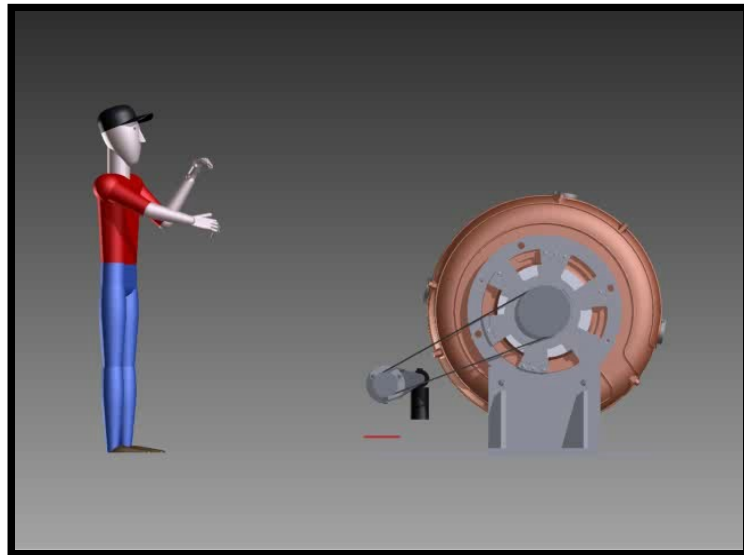
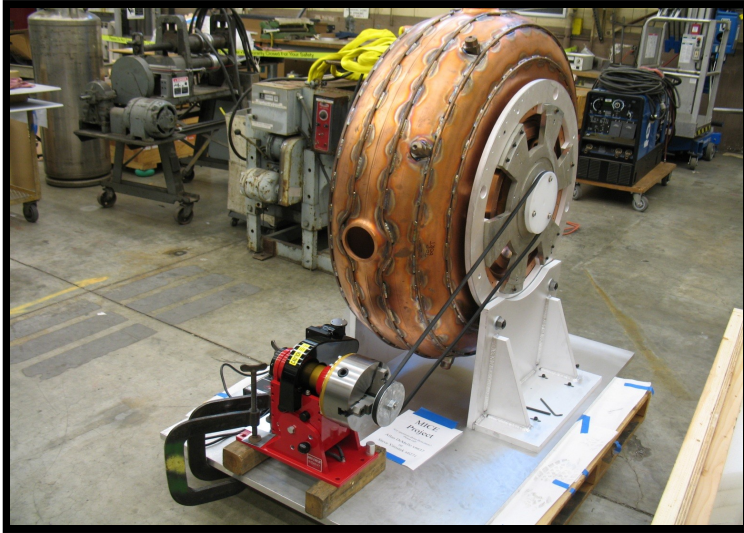
Electropolishing on MICE 201 cavity at LBNL

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For 805 MHz modular cavity review at SLAC, Oct 2012.

Electropolishing (EP)

- Copper cavity breakdown in high magnetic field. Several different explanations, but all related to the field emission electrons.
- Smoother surface -> less field enhancement & less field emission electrons.
- EP: electrolytic removal of metal in a highly ionic solution by means of an electrical potential and current. How exactly does it work? Not fully understood yet.
- EP widely used in SRF for surface treatment. Shining surface with roughness of hundreds to tens of nm.

EP procedure



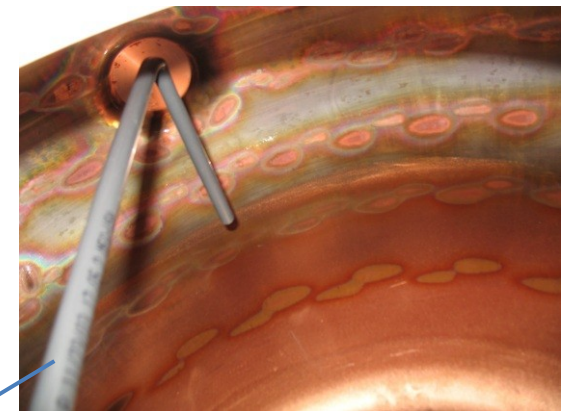
- Mechanical polishing
 - Smooth surface fairly and remove any defects that can't be addressed by EP.
- Preclean
 - Remove dust & grease by rinsing water, brushing with D909 cleaner and dried with compressed air/ nitrogen gas
- EP
 - Pre-inspect: leakage , grounding loop, etc.
 - Install U-shape cathode, pump in Power Kleen 500 EP solution.
 - Rotate and wet the cavity thoroughly, deoxidize the copper.
 - Turn on the rectifier and set voltage at 7 Volts, rotate the cavity until the desired surface finish is achieved.
 - Pump out solution fast, clean and pack.

EP Setup

Ducting

Electrolyte

Cone shape exhausting hood

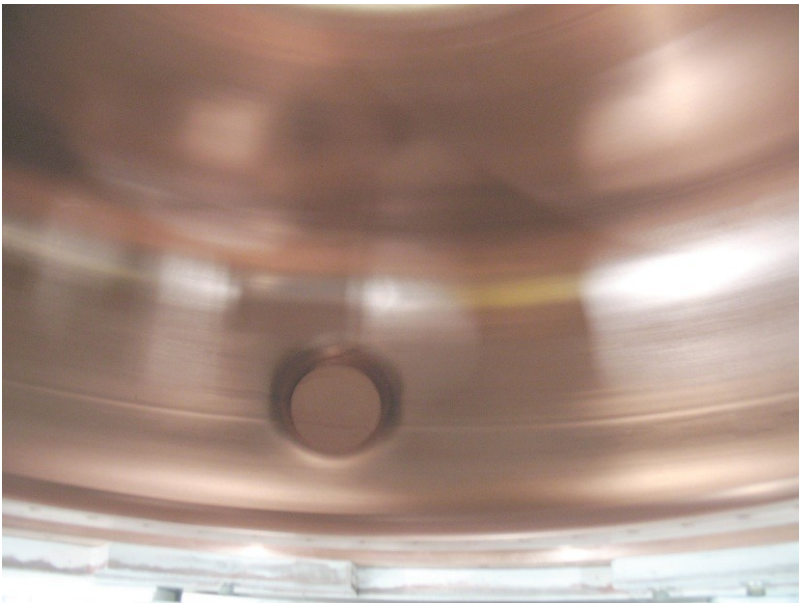
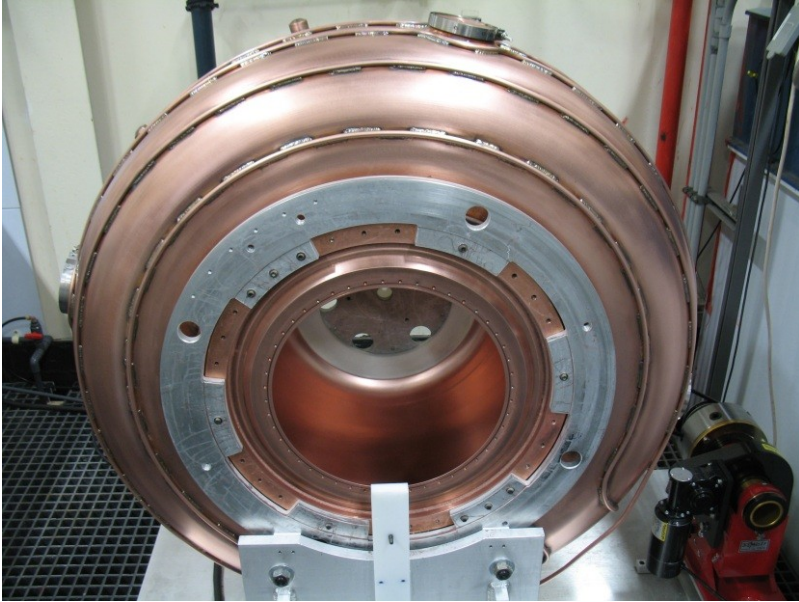


D909
Cleaner

Hydrogen gas Monitor

Compressed air purge

EP Result



Bright Dip?

- Bright dip (BD), or chemical buffering process (CBP), is an electroless surface polishing process.
- Mild and slow chemical process, easier and safer to control.
- Need a very fine hand polishing before the BD.

Bath	SN6	SN2	SN10
C_{H2SO4} (M)	5.8	7.7	4.8
C_{HNO3} (M)	0.87	1.15	0.72
C_{HCl}(M)	1.610 ⁻²	1.010 ⁻²	1.310 ⁻²
C_{CuSO4}(M)/EDTA* (M)	0.3	0.24	0.1/0.2
θ (°C)	25	35	23
Etching duration (min.)	105	40	60
Removed layer (μm)	450	150	50
Roughness Ra (μm)	0.10	0.025	0.015

“DETERMINATION OF NIOBIUM FILMS SURFACE RESISTANCE BY A CALORIMETRIC METHOD”
M. Fouaidy, etc

Sample Test

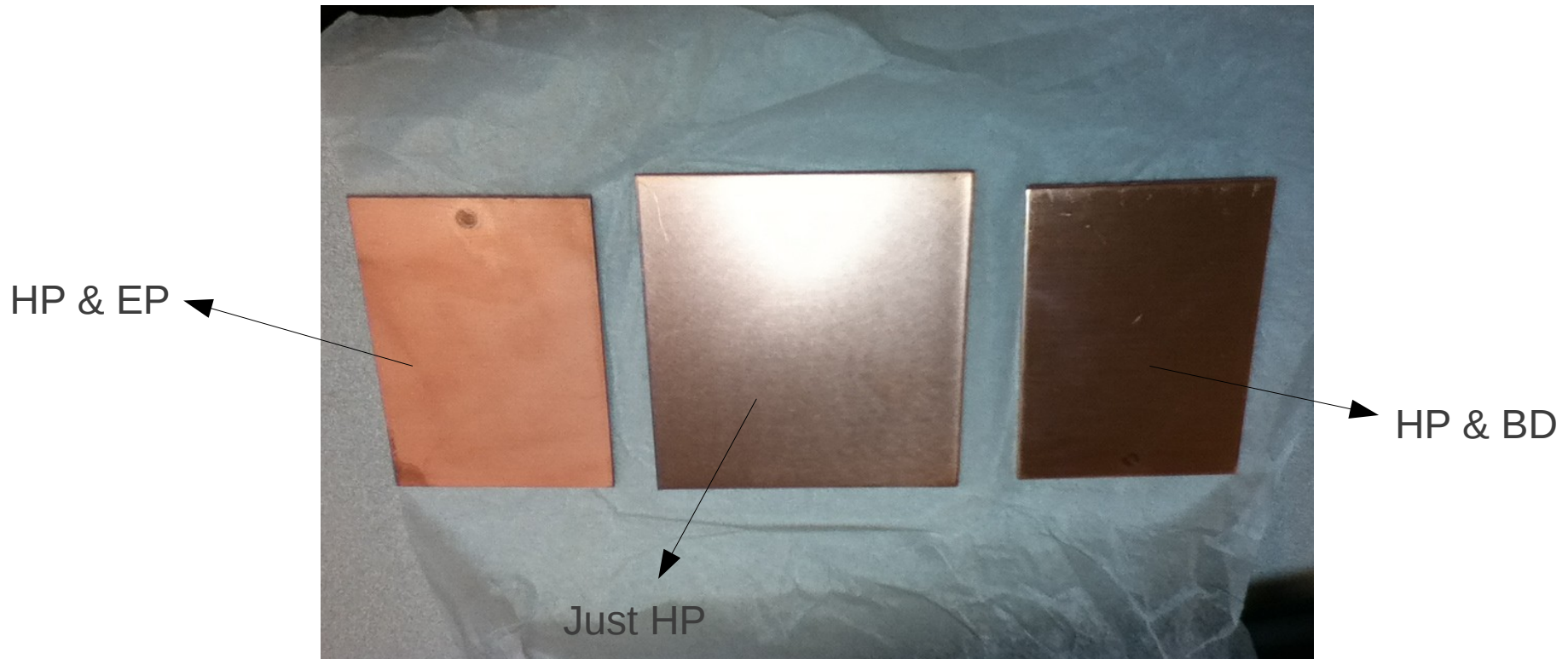


Table 1: Profilometer Measurements of the Roughness Average (RA) of OFHC sample plates.

Sample	Just HP	HP with EP	HP with BD
RA (μm)	0.140	0.537	0.108

End
Thanks!