

Superconducting Cavities

Preparation & Testing – Draft for BCD

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- Description of Cavity Preparation
 - Basic steps
- BCD proposal for Cavity Preparation Process
- Disclaimer:
 - This assumes the the material BCD choice: fine grain material
 - For large-grain material choice might change (see materials section)



General Requirements - Overview

- The preparation of the cavities should finally result in fully assembled cavities (incl. power coupler to) which are ready for string assembly.
- After delivery from the welder, several things are to be done:
 - a Mechanical checks, inspection
 - b Frequency tuning
 - c Cleaning
 - d Damage layer removal
 - e Furnace treatments
 - f Final frequency tuning
 - g Final surface preparation
 - h Final cleaning
 - i Bake-out at 120-130°C
 - j Low-power acceptance test
 - k Tank-welding
 - l Assembly for high power operation
 - m High-power test
- Although all these steps need improvements in QA/QC for a mass production, the most challenging one is to define final (electro-)chemical surface preparation to deliver a reliable and reproducible performance.
- The overall workflow needs optimization.

Agreed High Priority R&D Issues

- Field emission control is the major R&D issue
 - Field emission is the major source for a large performance spread of cavities
- Quality control issues for surface preparation needs a major effort
 - E.g. acid quality control
 - Surface quality after several preparation steps needs to be controlled
 - Roughness control before final EP
 - Rinsing procedures need quality control
 - E.g. online-monitoring of particles in water from water draining out of the cavity
 - Reduction of cross-contamination due to integration of quality control steps (e.g. frequency tuning) inside the cleanroom
- Mass production issues for many steps need work
- Basic R&D needed for understanding ‘recipes’ that work: e.g. Bakeout etc.



BCD Proposal

- Hottest topics
 - Damage layer Removal
 - BCD: Electropolishing (EP)
 - ACD 1: Mechanical Grinding + small etch or EP
 - ACD 2: Etch
 - Furnace treatment
 - BCD: 800°C
 - ACD: 1400°C
 - Final surface preparation
 - BCD: EP
 - Final cleaning
 - BCD: High Pressure Rinsing with ultra-pure water
 - ACD 1: Dry-ice cleaning
 - ACD 2: Megasonic rinsing
 - Bakeout
 - BCD: 'In-situ' bakeout 120
 - ACD: Air bakeout as part of the drying process

