Cornell University
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Testing Superconducting RF Cavities of the Highest Field Gradients for the ILC

Chemical Treatment Comparisons for a Large-Grain Superconducting RF Cavity

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What is the ILC?

- ILC = International Linear Collider
- The ILC is a proposed electron-positron collider that uses superconducting radio-frequency (SRF) cavities for acceleration
  - ~16,000 SRF niobium cavities are needed
  - All cavities must reach accelerating gradients of 35 MV/m during tests
- Chemical treatments of SRF cavities help us reach the 35 MV/m goal

SRF Chemical Treatments

- **BCP:** Buffered Chemical Polish
  - Interior of cavity is immersed with an acid solution
  - Cavity surface is etched
  - Preferentially etches grain boundaries
- **EP:** Electropolish
  - An electrochemical process that also etches
  - Gives the cavity a smoother mirror-like finish
  - Does not preferentially etch grain boundaries

Eliminating Electropolish?

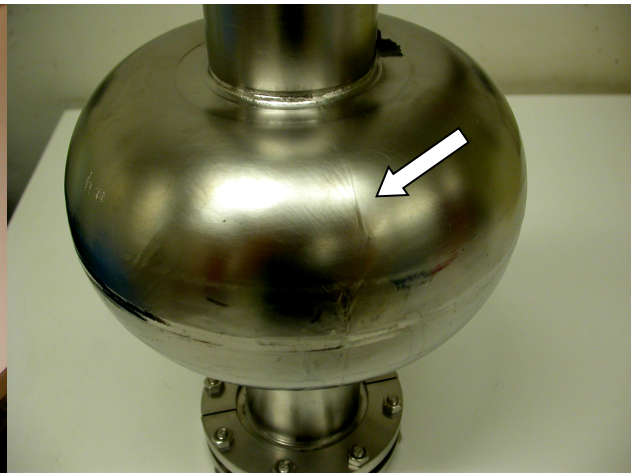
- Typically, both a BCP and an EP are performed
  - no EP leads to a poorer performance
- However, the EP procedure is more complicated, time-consuming, and costly than BCP
  - *If we can eliminate EP, we can simplify the chemical treatment process and save resources*
- Large-grain cavities have few grain boundaries
  - We may only need a BCP → if so, great!

Grain Sizes in Cavities

- Fine, medium, and large grain niobium cavities are all possible to fabricate

Fine Grain

Medium Grain



Large Grain

- Previous studies indicate that grain boundaries do not affect cavity performance in RF fields

Project Goals

- Continue with cavity preparation and testing
  - Cleanroom assembly and disassembly of cavities
  - High pressure rinsing of cavities
  - Cavity bakes
  - Low-temperature cavity tests
- Some of the cavity tests will be for comparing the chemical treatments on a large-grain cavity
  - Perform cavity test after a BCP
  - Perform another cavity test after a BCP and EP
  - Will one cavity test perform better than the other?