Materials
and
Material R&D in Support of ILC

2nd ILC Workshop
Snowmass, Aug. 13 – 27, 2005

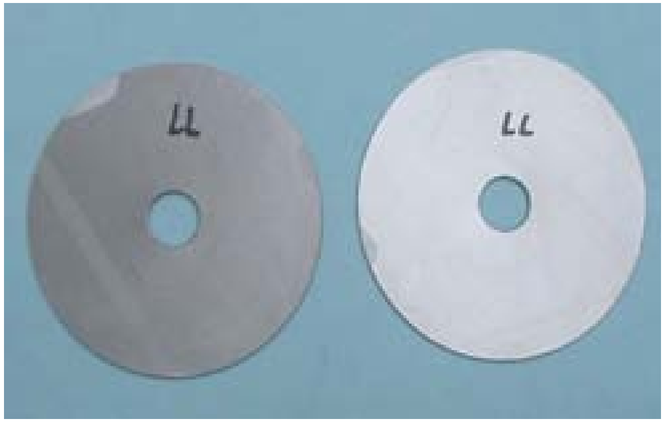
Summary[1]

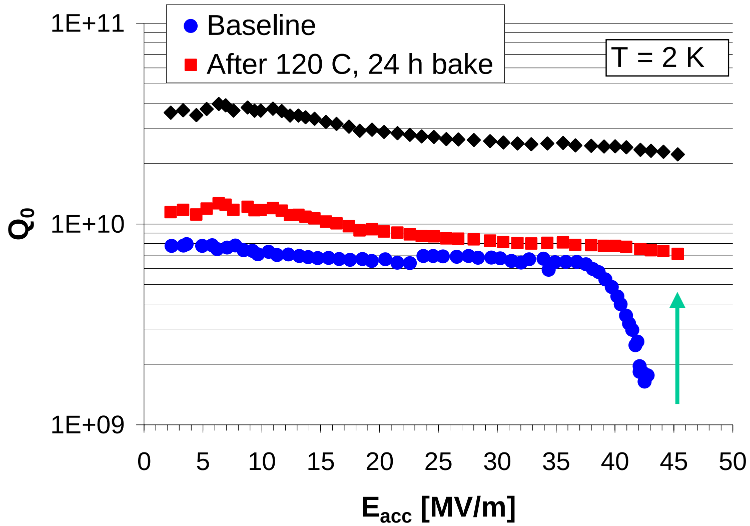
- ACD Choice:fine grain (standard) niobium with RRR$\geq$300
  - Well characterized properties
  - Existing specifications
  - Readily available
  - Used successfully in many cavities with high performance
- BCD Choices:
  - Large grain/Single Crystal Niobium with RRR$\geq$ 300
    - Potential advantages: similar performance
      reduced costs: $\geq$ 250 Mill $
      "streamlined" procedures,e.g. BCP vs EP
      easier QA

    Initial on SC cavities results are encouraging, verification on MC cavities
  - Nb/Cu clad material with RRR$\geq$ 300
    - Material successfully developed, high performance demonstrated on SC
    - Further developments necessary for multi-cell cavities($\geq$ 2 years)
    - Problem areas: material still quenches, Q-degradation,cooldown,technology for multi-cell cavities

Large Grain/Single Crystal Niobium[3]

Nb Discs





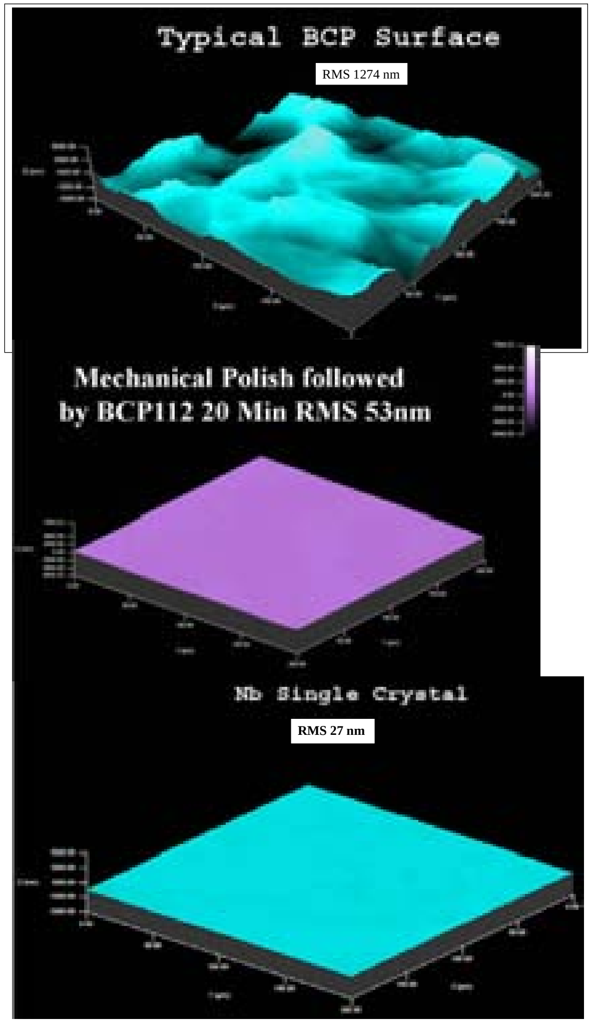
LL cavity 2.3GHz

E_{peak}/E_{acc} = 2.072

H_{peak}/E_{acc} = 3.56 mT/MV/m

Surface Roughness (1)

BCP provides very smooth surfaces as measured by A.Wu, Jlab



RMS: 1274 nm fine grain bcp

53 nm after ~ 35 micron, single Crys

27 nm after ~ 80 micron,single Crys

251 nm fine grain ep

Summary[2]

Material R&D:

- What is the limiting magnetic field for Nb?
  - Analysis of existing data by K.Saito: H_{crit}~ 180 mT
  - Verification with special cavities, e.g single crystal TE_{011}
  - Influence of “defects”,grain boundaries, flux penetration
- What is the physics of the “Q-drop”?
  - Proof of “Hot Spot” model [A.Gurevich, SRF2005] with T-maping and surface investigation
  - Proof of oxygen diffusion model [G.Ciovati,SRF2005]
  - Effect of flux penetration
  - Frequency dependence
- How does the surface condition/oxidation influence rf performance(Q-slope, residual resistance,BD field)?
  - Atom probe tomography of Nb subjected to different surface treatment
  - Special devices, e.g TE_{011} endplate/coaxial cavities, different surface treatments
  - T-mapping