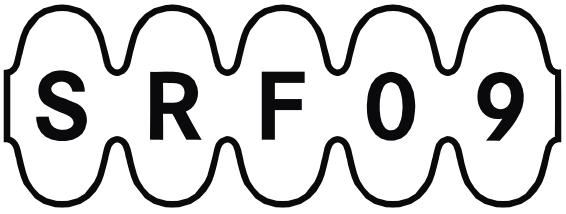


Berlin · Dresden

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**Conference Programme and Abstracts**

locations and characterize changes and the migrations of the quench locations during processing. Using a vertically electropolished cavity, the temperature dependence of the superheating field was found to agree with Ginzburg-Landau predictions to within 10% down to a temperature of 4.2K; whereas prior to this experiment, theory and experiment only agreed at temperatures greater than 6.2K. We also used finite element methods to simulate the internal heating of the cavity, allowing for a more accurate measurement of superheating field as a function of temperature.

TUPPO073

## Surface Investigation of Samples Extracted From Prototype Cavities for European XFEL

**W. Singer**, S. Aderhold, A. Ermakov, X. Singer, K. Twarowski (DESY) P.M. Michelato, L. Monaco (INFN/LASA) F. Schoelz (W.C. Heraeus GmbH COPY, Materials Technology Dept.)

Few cavities of the 4th and 6th cavity generation treated accordingly the XFEL recipe have shown performance of ca. 15 MV/m caused by thermal break down without field emission. Effort to post purify some cavities with titanium, that was successfully applied for FLASH cavities, did not improve the performance. The T-map analysis detected the quench areas mainly close to the equator. Optical control by high resolution camera and non-destructive X-Ray radiography have been applied and allowed to monitor the defects in some cases with good correlation to T-map observation. In order to get more detailed information of defects some samples have been extracted from cavity and investigated by light microscope, SEM, EDX and Auger spectroscopy. The detected distinctions are discussed

TUPPO074

## Structure of the Electron Beam Welding Connections

**X. Singer**, A. Ermakov, A. Matheisen, A. Schmidt, W. Singer (DESY)

The structure, properties and welding parameters of Nb55%Ti -Ti and Nb55%Ti-Nb connection of cavities for XFEL are investigated. These are for example the welding connections of conical disc with helium tank rings (bellow unit and reduction ring) and of conical disc with reference ring. Several samples have been prepared using the electron beam welding equipment of DESY and Lufthansa Technik AG. The metallographic structure analysis, EDX, measurement of gas content, Vickers hardness HV, RRR and electrical resistance measurement have been done. Properties of the welding connection Nb55%Ti-Nb present mainly the bcc body-centered cubic ß-phase according the phase diagram of NbTi alloy. The HV changes rather uniformly, annealing at 1400°C does not lead to changes of the behaviour. The small maximum of the critical superconducting temperature Tc in agreement with the element distribution in the welding connection is observed. Properties of the welding connection Nb55%Ti-Ti present the mixture of the bcc ß-phase and the hexagonal $\alpha$-phase. Maximum of the HV and increased hydrogen content in the welding connection was observed.

TUPPO075

## Surface Morphology of Welding PITs on HAZ of Electropolished Nb

**Z.H. Sung**, S.R. Boland, D.C. Larbalestier, A. Polyanskii (ASC) P.J. Lee (NHMFL)

Combined investigation with newly-developed cavity surface optical inspection and typical T-mapping system have shown that pits in the Nb in the heat-affected zones (HAZ) of electron welds are a source for the thermal breakdown of the surface superconducting state during strong RF operation. Magnetic fields flowing over the cavity surface in RF fields could be enhanced above the critical field when passing over the rim of such topological features. Hence, better understanding the mechanism of local magnetic field enhancement on the pits is being addressed. We have performed a quantitative study, using high resolution confocal laser scanning microscopy, of pit topology in the HAZ of electropolished Nb coupons prepared at FNAL.

We also performed a preliminarily investigation into the effect of PITs on superconductivity with magneto-optical imaging but did not observe a change in flux penetration under DC field. In addition, pits on the HAZ of welds of FNAL cavity TE1AE004 were topologically studied after making a replica of this pit with silicone molding.



## Evidence for Suppressed Superconductivity by Direct Transport Measurements of the Critical Current Density Across Buffered Chemical Polished Grain Boundaries of SRF Quality Niobium

**Z.H. Sung**, D.C. Larbalestier, A. Polyanskii (ASC) A.V. Gurevich, P.J. Lee (NHMFL)

We extracted bi-crystals from large-grain SRF-quality Nb and examined current transport through the single grain boundary (GB) using magneto-optical (MO) imaging, measurements of surface topology, and direct transport across the GB in the superconducting state, and by transmission electron microscopy of the same GB. We have observed preferential flux penetration along GB both by MO imaging and by flux flow characteristics of the inter-granular transport. Using techniques developed for high-Tc superconductors [1], we explored the depairing critical current density of Nb grain boudnary, finding significant similarities, and also some difference, from the flux flow state of hybrid Abrikosov-Josephson vortices in low angle GBs of YBCO. Our data indicate that pinning of vortices along GBs is weaker than pinning of vortices in the grains, which may indicate suppressed superfluid density on GBs, which thus can contribute to enhanced rf losses in hotspots on the surface of Nb cavities.

[1] A. Gurevich et al., Phys. Rev. Lett. 88, 097001-4 (2002)



## Superconducting Thin Films on Metals by Pulse Laser Deposition at KEK

**S. Mitsunobu**, S. Inagaki, M. Yoshida (KEK)

Superconducting Thin Films on Metals by Pulse Laser deposition at KEK S.Mitsunobu, S.Inagaki, M.Yoshida, K.Saito, H.Nakanishi and M.Wake KEK At KEK, the test of MgB2 thin films on Cu, Ti and Nb by Pulse Laser Deposition(PLD) method based on a fabrication method developed by NIMS have been studied and RF surface resistances have been measured. The direct deposition of MgB2 film on Nb showed two step decrease of the surface resistance. For a TM010 cavity, formed MgB2 films showed no superconductivity at this time due to different heat treatment conditions from disk samples, so we cutting cavity quadruple and one of them used as target. And heat treated as usual. This quadruple shows superconducting transition.



## Interaction Niobium Oxide and Superconductivity

**Th. Proslier** (IIT) J. Norem (ANL)

The interactions between niobium oxides and superconducting niobium are complex and non-trivial. We will present a summary of the results obtained by PCT on cavity-grade coupons that suggest magnetism as a possible cause for non-ideal cavity performances. Atomic Layer Deposition and a high temperature baking has been used as a technique to improve the superconducting properties of niobium and protect it from oxidation. Data from an Alumina coated Cavity test before and after a High temperature baking will be presented. We will present as well a study of the damaged induced by High Pressure Rinsing on Nb coupons.