

ACCELERATOR SEMINAR

“Nonlinear Properties of MgB₂ Under Localized High RF Magnetic Field*”

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In order to increase the accelerating gradient of Superconducting Radio Frequency (SRF) cavities, Magnesium Diboride (MgB₂) opens up hope because of its high transition temperature and low surface resistance in the high RF field regime. However, due to the presence of the small superconducting gap in the π band, the nonlinear response of MgB₂ is potentially quite large compared to a single gap s-wave superconductor such as Nb. Understanding the mechanisms of nonlinearity coming from the two band structure of MgB₂ is an urgent requirement. A localized and strong RF magnetic field, created by a magnetic write head, is integrated into our nonlinear-Meissner-effect scanning microwave microscope [1]. Several MgB₂ films (thickness 50 nm, 140 nm and 150 nm) fabricated by a hybrid physical-chemical vapor deposition technique on dielectric substrates are measured at a fixed location and show a strongly temperature-dependent third harmonic response. We propose that at least two mechanisms are responsible for this nonlinear response, one of which involves vortex nucleation and penetration into the film. This microscope will also be employed to identify defects that degrade the RF performance of Nb and MgB₂ in SRF cavities in the near future.

[1] Tamin Tai, X. X. Xi, C. G. Zhuang, Dragos I. Mircea, Steven M. Anlage, “**Nonlinear Near-Field Microwave Microscope For RF Defect Localization in Superconductors,**” [IEEE Trans. Appl. Supercond. 21, 2615-2618 \(2011\)](#).

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Thursday, June 16, 2011

3:30 p.m.

CEBAF Center, Room A110

Coffee before seminar at 3:15 p.m.