MODULATION FIELD EFFECT ON THE BOUNDARY CURRENT RESPONSE OF $BA_{0.34}K_{0.64}FE_2AS_2$ SUPERCONDUCTING SINGLE CRYSTALS PROBED BY NON-RESONANT MICROWAVE ABSORPTION

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ABSTRACT

Boundary current response of $Ba_{0.34}K_{0.64}Fe_2As_2$(BaK122) Single Crystals Probed by Non-Resonant Microwave Absorption as a function of 100KHz modulation field at low temperatrure, namely, 4.2K. The measurements were done for both field parallel and perpendicular to the iron arsenide plane configuration. A weak anisotropic effect is noted. However it is observed that the boundary current response depends on the modulation field value and it increases as we increase the modulation field value from 1 to 9 Gauss.

Keywords: Non resonant microwave absorption, BaK122 Single Crystal, Boundary current response, Anisotropy, Iron Arsenide plane.

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1. NTRODUCTION

Non-resonanct microwave absorption (NRMA) was first discovered by Bhat et. al. [1] in high-Tc cuprate superconductors. It was then followed by many groups all over the world [2-5]. Further over the years the phenomenon has emerged as a powerful technique to probe different superconductors and their properties [6-12]. One of the important property to be successfully probed is the boundary current response in YBCO superconductors [13]. In this paper we adopt this technique to probe the $Ba_{0.34}K_{0.64}Fe_2As_2$ (BaK122) superconducting single Crystals for their boundary current response and the anisotropy. We report here on the detailed boundary current response and its dependence on modulation fields.

2. EXPERIMENTAL

NRMA measurements were carried out by Bruker spectrometer operating at 9.4 GHz with Oxoford cryostat facility that can go to 4.2 K. 100 KHz modulation frequency and field amplitude in the range of 1 -9 Gauss has been used in these measurements. The DC field is applied in parallel and perpendicular to the Iron Arsenide plane configurations. BaK122 single crystal was grown using a self-flux method. Details of crystal growth are given elsewhere [14].

3. RESULTS AND DISCUSSION

Figure 1 shows the NRMA signals at 4.2 K as a function of modulation field, when the DC field is applied parallel to the iron arsenide plane of the crystal. This is the superconducting plane. One can see a clear boundary current hysteresis type response at all modulation fields and particularly the response increases with increasing modulation field amplitude. In **Figure 2** we show the NRMA signals measured at 4.2 K as a function of modulation field, when the DC field is applied perpendicular to the iron arsenide plane of the crystal. Again there is a clear boundary current hysteresis type of response for all the modulation field amplitudes. One can notice a very weak anisotropy effect at this temperature. An increasing boundary current response is expected as the modulation field amplitude is increased till the first flux penetration H_{c1}. However at this low temperature the $H_{c1}$for thiscrystal is definitely higher than 9 Gauss as we still see a clear boundary current response and not a fluxon motion dependent viscous loss [11]. A strong boundary current response indicates a strong magnetic field shielding by the superconducting crystal.

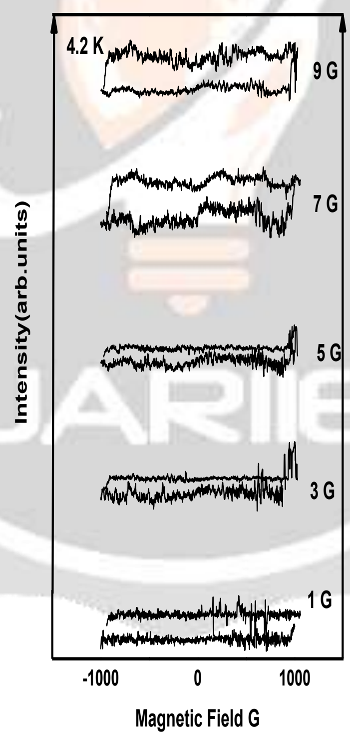

Figure1. *NRMA signals at 4.2 K as a function of modulation field, when the DC field is applied parallel to the iron arsenide plane*

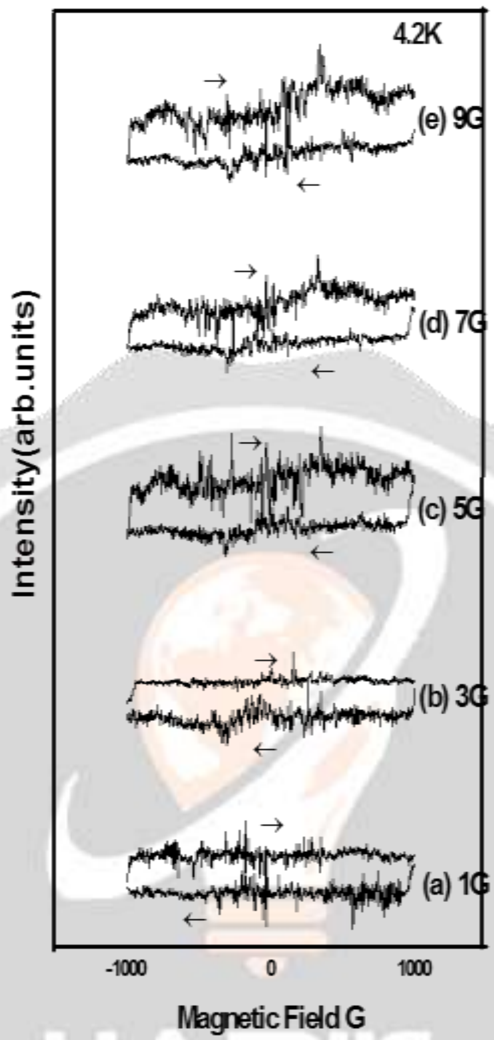

Figure 2. *NRMA signals at 4.2 K as a function of modulation field, when the DC field is applied perpendicular to the iron arsenide plane*

4 CONCLUSIONS

Boundary current response of BaK122 superconducting single crystal was probed by Non-resonant microwave absorption technique. A detailed measurement at 4.2 K was carried out with modulation fields in the range 1 -9 Gauss. An increasing boundary current response as the modulation field is increased is observed. This indicates a strong shielding effects of the crystal for alternating magnetic fields. There is a negligible anisotropy as observed in these crystal response at very low temperature.

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5. REFERENCES

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