Combined analysis method applied to the study of texture of Bi$_2$Sr$_2$CaCu$_2$O$_8$ bulk superconductor samples

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1- Introduction

Bi$_2$Sr$_2$CaCu$_2$O$_8$ bulk superconductive samples

High supercurrents (Jc$_{170}$=1200A/cm$^2$) even with weak texture

Industrial applications: fault current limiters [1]
cables, magnetic screen

2- Conclusions

Multiphase samples with Bi2212 as the main phase

Texture varies along the wall thickness of the sample

Texture is better in the inner part of the sample

Texture variation is a consequence of the synthesis method (melt cast process)
c axes are oriented in XY plane of the sample

Prospects:

- Vary samples shape and synthesis parameters
- Improve Jc

3- Objectives

- Improve Jc

Correlate texture and macroscopic properties

Study the effect of different parameters (shape, oxygen content,...) on Jc

Use Combined Analysis method [3]: neutron (macroscopic), X-ray (near-surface), and electron diffraction (microscopic)

4- Data measurement

Beam

- Neutrons or X-rays

Debye-Scherer rings

Data for 1 y value : 360° in $\phi$, 20 and intensity

Rietveld refinement

with Maud

Phases identification

Intensity (cps)

20 (Degrees)

Six phases were identified in different proportions and used for Rietveld refinement. The main phase is the superconductive one, Bi2212.

6- Results

Texture study with neutrons

There are four main parts in the sample: inner, center, outer and a porous one. The center part is more textured and presents higher supercurrent values [5]. The normalized pole figure 002 of the center part reveals that c axis are parallel to the tube axis.

Electron microscopy

14-24 AEC and Bi2212 phases were identified by EDX

Prospects:

- Vary samples shape and synthesis parameters
- Improve Jc

5- Pole figures

- c $\parallel$ Z
- c $\perp$ Z

EBSD

There is not enough Kikuchi lines to obtain a mapping of grains in the sample. Polishing technique needs to be improved.

Prospects:

- Vary samples shape and synthesis parameters
- Improve Jc