

POROSITY EVALUATION OF BI-2223 HIG-TC SUPERCONDUCTOR SAMPLES VIA DIGITAL IMAGE PROCESSING

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Abstract – Processing (Bi, Pb) – 2223 via peritectic decomposition may improve the density and microstructure of this superconductor. In the present work, samples of (Bi, Pb) - 2223 with different fractions of Ag and PbO have been heated above the peritectic decomposition temperature and further slowly cooled. The porosity of these samples has been evaluated by means of digital image processing.

Nowadays there is a great progress in industrial scale production of Bi-2223/Ag superconducting tapes. However, a relatively high porosity is generally found in sintered bulk samples of (Bi, Pb)-2223 (Figures 01 and 02). Such porosity can reduce the critical current density of the superconducting material. In addition, the mechanical properties of the ceramic bulk can also be affected by porosity. The porosity of (Bi, Pb)-2223 samples is evaluated in the present work. The (Bi, Pb)-2223 phase was produced by sintering a commercial precursor powder with $94.58\% \pm 2.43\%$ of this phase [1]. The samples were further processed by peritectic decomposition and recrystallization [1-2]. Silver powder and lead oxide were added to the samples before the partial-melting step, in order to lower the melting temperature and to promote (Bi,Pb)-2223 recrystallization from the melt. The samples were investigated by X-ray diffraction (XRD), scanning electron microscopy (SEM / EDS) and Optical Microscopy (OM). The porosity of sintered and melt-processed samples has been evaluated by means of digital image processing of SEM and OM micrographs.

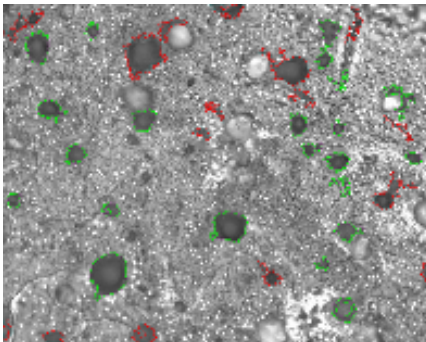


Figure 01: OM Image of a precursor sample with Ag addition.

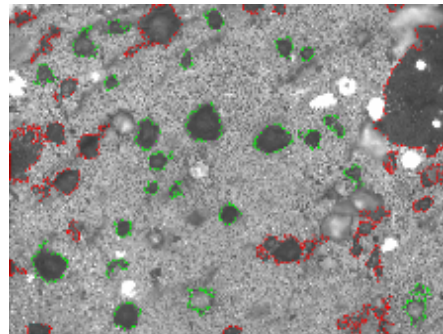


Figure 02: OM image of a precursor sample with PbO addition.

References

- [1] E. R. Bispo. "Processamento por decomposição e recristalização da fase supercondutora de alta vT_c (Bi,Pb)-2223 com adição de PbO e Ag". Master's thesis defended in August 2008, in DCMM / PUC-Rio.
- [2] E. Giannini, et al. "Reversible melting and equilibrium phase formation of (Bi, Pb)₂Sr₂Ca₂Cu₃O_{10+ δ} ". 2002 Supercond. Sci. Technol. 15 1577-1586 doi:10.1088/0953-2048/15/11/316.