WBP7-1

The microstructure characterization and phase composition analysis of (Bi,Pb)-2223 Ag/tapes with SnO, MgO and Ag_2O mix-doping

*Xiaoye Lu[1], Danqing Yi[2], Taisuke Fujino[1], Akihiko Nagata[1]

Akita University, Japan[1]
Central South University, China[2]

Among all the high-temperature superconductors discovered to date, Bi-2223 oxide superconductor is the most promising material for tapes and wires for high-current applications. However, critical current density is strongly influenced by the presence of pinning defects and their possible matching with the cores of the vortex lines. The defect structure is essential for flux pinning enhancement, which is in particular, the most important problem for the Bi-based superconductors. In previous work, we studied effect of SnO, MgO and Ag_2O mix-doping on the formation and superconducting properties of Bi-2223 phase of Ag-sheathed tapes in the partial-melting and sintering process. The tape with 0.2wt% SnO, 0.2wt% MgO and 0.2wt%Ag_2O mix-doping shows the highest proportion of Bi-2223 phase and the highest critical current density. In the present work, we studied the microstructure characterization and phase composition distribution of (Bi,Pb)-2223 Ag/tapes with SnO, MgO and Ag_2O mix-doping. A major Bi-2223 phase coexisted with a few Bi-2212 phase, and large $(Sr,Ca)_2CuO_3$ (~10μm) and fine (~1μm) MgO particles in the tape with 0.2 wt%SnO, 0.2 wt%MgO and 0.2 wt%Ag_2O mix-doping. The Sn and Pb amount in the Bi-2223 crystals is larger than that in the Bi-2212 crystals. It suggests that the SnO doping is favorable for the formation of the Bi-2223 phase. The MgO doping can increase J_c due to improving the flux pinning.

Keywords: Bi-2223, mix-doping , flux pining, phase composition distribution

WBP7-2

Effects of rolling passes on the transport properties of 37-filamentary AgAu sheathed Bi-2223 tapes

*Xiaobo Ma[1,2], Shengnan Zhang[2], Guo-qing Liu[2], Huiling Zheng[2], Chengshan Li[2], Pingxiang Zhang[1,2], Jinshan Li[1]

State Key Laboratory of Solidification Processing, Northwestern Polytechnical University, Xi'an 710072 China[1]
Northwest Institute for Nonferrous Metal Research (NIN), Xi'an 10072 China[2]

37-filamentary AgAu sheathed Bi-2223 tapes were fabricated by powder in tube (PIT) process. And the round wires (Ø1.86mm) were rolled to 0.35 mm tapes with 12, 7, 5, 4 rolling passes through flat rolling, respectively. The influences of different rolling passes on the core density, deformation and transport properties of Bi-2223/AgAu tapes were systematically investigated. It was noticed that after rolling, the Vickers micro-hardness values of superconducting core and deform homogeneity along both the horizontal and vertical directions on the cross-section of 7 passes tape were better than those on the tapes with other passes. Meanwhile, it was observed that when the rolling reduction ratio was too large with 4 and 5 passes, sausaging phenomena would appear on the interfaces between AgAu sheath and superconducting core , while for the wires with 12 and 7 passes, the AgAu/superconducting core interfaces were much flatter. With the rolling passes decreasing from 12 to 4, the critical current density J_c first increased and then decreased. Due to the better homogeneity and flatter interfaces, J_c reached the maximum value of 14.8 kA/cm^2 on the 7 passes sample.

Keywords: Bi-2223/AgAu tapes, rolling passes, sausaging, critical current density

WBP7-3

Effect of grinding method on the precursor powder of Bi2223 and properties of strip

Guoqing Liu[1], Huiling Zheng[1], *Pengfei Wang[1], Qingbin Hao[1], Shengnan Zhang[1], Xiaoyan Xu[1], Gaofeng Jiao[1], Lijun Cui[2], Chengshan Li[1]

Northwest Institute For Nonferrous Metal Research ,China[1]
Western Superconducting Technology Co., Ltd, China[2]

Abstract: In this paper, the two kinds of precursor powders of BiPb2212 and CaCuO2 were prepared by double powder method and an improved coprecipitation method, then the BiPb2212 powders were fabricated by mechanical grinding and hand grinding. The BiPb2212 powders and CaCuO2 powders were prepared by two kinds of grinding methods mixed with a certain proportion of grinding, the multi-core Bi2223 superconducting tape with 37 cores were prepared by removeing the carbon、filling tube and annealing. The XRD analysis、SEM observation、laser particle size analysis and the tap density test of the precursor powders of the BiPb2212 were carried out respectively by mechanical grinding and hand-grinding.The results showed that the phase composition, microstructure, particle size distribution and tube density detection were all significant differences by the using two kinds of grinding methods. Finally, the superconductivity test of the heat treatment strip of Bi2223, the results show that the Bi2223 multi-core strip at 77K, the critical current from the field improved from 86A(hand-grinding method) to 127A(mechanical grinding method). Therefore, the the precursor powder by using mechanical grinding method, the Bi2223 multi-core strip is more conducive to obtain high-performance.

Keywords: BiPb2212, CaCuO, Mechanical grinding method, Critical current

WBP7-4

Longitudinal magnetic field effect in critical current characteristics of Bi-2223 superconducting tape

*Xuan Wu[1,2], Baorong Ni[1]

Department of Information Electronics, Fukuoka Institute of Technology, Japan[1]
School of Electronic and Optical Engineering, Nanjing University of Science and Technology, China[2]

As one of the important high-T_c superconductors, Bi-2223 superconducting tape has a large potentiality of applications in electric power field. However, at the present stage, the critical current density (J_c) is still much lower than the practice level. In this study, we focused on the longitudinal magnetic field effect in critical current densities, investigated the enhancement of the electrical conduction properties due to the effect in a commercial Bi-2223 superconducting tape. Since the samples used in this study are polycrystalline and tape shaped, the longitudinal magnetic field effect is expected to differ from that in single crystal or conventional superconducting alloy, Therefore, the critical current characteristics at an up to 5T of magnetic field as well as at various angles between magnetic field and current were measured in detail. It was found that an apparent longitudinal magnetic field effect exists in our samples, though the quantitative behavior of the enhancement of J_c is quite different from those observed in conventional metallic superconductors. We also found that the enhancement depends not only on the angles of magnetic field applied, but also on the anisotropic upper critical field (B_{c2}) of samples. Based on these experimental results, the utilization and optimization of the tape were discussed in the case of applying it to the manufacture of the power cable.

Keywords: Bi-2223 superconducting tape, critical current density, longitudinal magnetic field effect