WBP5-1

Superconducting joint of $GdBa_2Cu_3O_y$ coated conductors by solid diffusion of the precursor films

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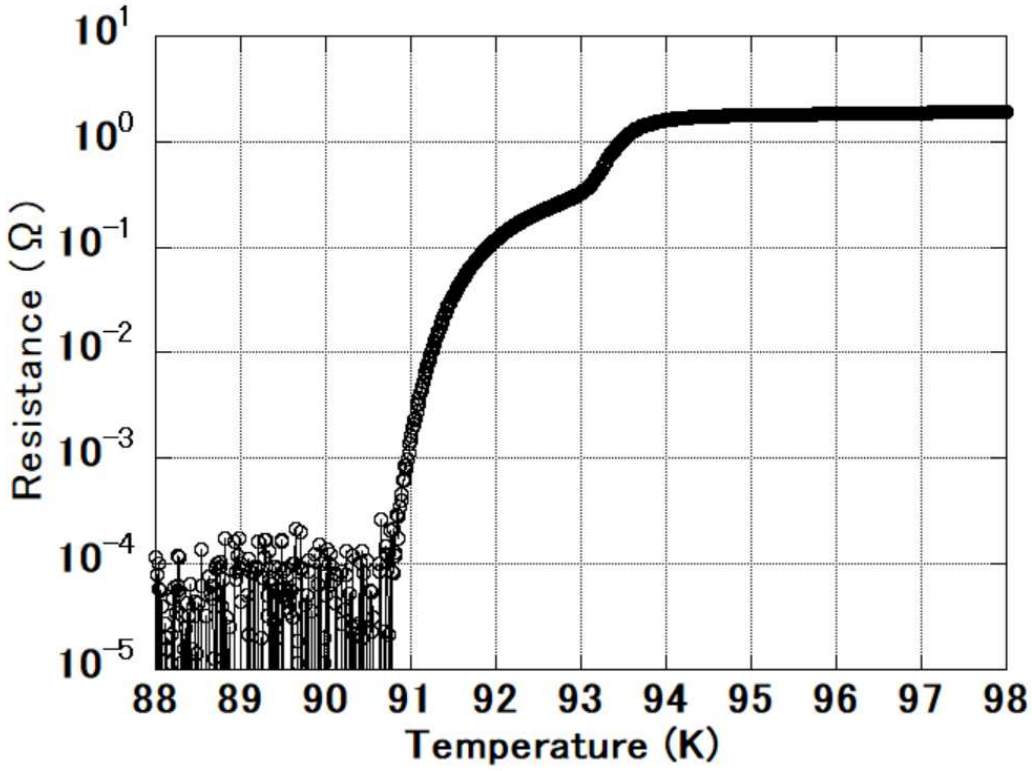
There has been a strong demand of achieving superconducting joint for $REBa_2Cu_3O_y$ coated conductors (CCs) to fabricate long length CCs for applications such as nuclear magnetic resonance and magnetic resonance imaging. In our study, superconducting joint was attempted by solid diffusion of the precursor films.

Two pieces of $GdBa_2Cu_3O_y$ precursor films were placed in a face to face manner, and pressed at 10 MPa then crystallized at 1093 K in the oxygen partial pressure of 5×10^3 Pa. Oxygen doping was carried out at 773 K in the oxygen of 1×10^5 Pa for 200 hours. Critical temperature (T_c) was measured by four-probe method.

Fig. 1 shows the relationship between temperature and resistance, which proves that superconducting joint was successfully achieved with T_C of 90.8 K. Two T_C onsets were seen from Fig. 1; one at 93.8 K and another at 93.0 K. They were probably due to non-overlapped area where oxygen was doped optimally and overlapped area with oxygen deficiency, respectively. In summary, superconducting joint was successfully achieved by solid diffusion of the precursor films.



Keywords: Superconducting joint, REBCO, Coated conductor

WBP5-2

Fabrication of superconducting joint of $REBa_2Cu_3O_y$ coated conductors by crystallization of additional precursor films

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There have been several techniques available to join REBCO coated conductors such as a diffusion joint using stabilizing layer [1], a solder joint [2], and a superconducting joint [3], to fabricate long length superconducting wires for magnet applications. Park et al. has reported zero resistance at the jointing interfaces using the direct superconducting joint technique, with high temperature heat treatment (1123 K) at high vacuum [3]. For industrial applications, lower temperatures and lower pressures are desired to achieve them.
In this work, GdBCO precursor films were fabricated additionally on GdBCO coated conductors using a pulsed laser deposition (PLD) process, then two pieces of which were stuck together with face-to-face manner, and then pressurized at 10 MPa and crystallized at 1093 K. The microstructures and temperature dependence of resistance of the joined sample were characterized by a cross-sectional transmission electron microscopy (TEM) and four-probe method, respectively.
As shown in Fig. 1 (a), two samples were successfully joined together without large pores and reacted phases at the joint interface. Fig. 1(b) shows the temperature dependence of resistance, which proves that superconducting joint was achieved with T_C of 90.8 K.

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[2] K. S. Chang, et al., IEEE Trans. Appl. Supercond. 18 (2008) 1220–1223.
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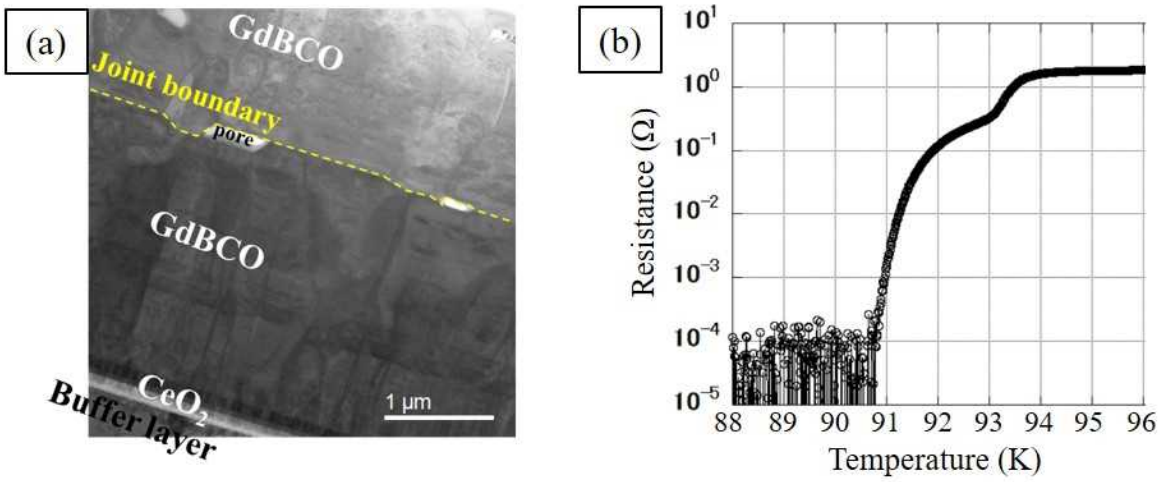

Keywords: Superconducting joint, REBCO, Coated conductor, Coated conductor

WBP5-3

Several methods to reduce the resistance of non-superconducting joint

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Two-generation high-temperature superconductor (2G-HTS) is one of the most popular technologies to achieve high and stable magnetic field. Finding a lower resistance joining method is very important for HTS superconducting magnet application which working in persistent current mode (PCM) because the field stability is determined by joint resistance. The common method of reducing joint resistance is currently increasing the overlap length. This paper focus on three respects to fabricate the lower joint resistance in the same overlap length. (1) Using arched structured in connection layer due to the non-uniform current distribution in joint area. (2) Using lower resistivity materials in connection layer. (3) Choosing moderate joining pressure. The experimental results of joint samples made by different YBCO tapes are presented to verify above methods synthetically.

Keywords: HTS, joint resistance , arched structured

WBP5-4

Superconducting Joints Using Bi-added PbSn Solders

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A nuclear magnetic resonance (NMR) spectrometer operated at 1020 MHz, corresponding to a magnetic field of 24 T, has been recently developed by combining an outer coil using low-T_c superconductors (LTS) of NbTi and Nb_3Sn, and an innermost coil using a high-T_c superconductor (HTS) of $Bi_2Sr_2Ca_2Cu_3O_{10}$ (Bi2223) [1]. Superconducting joints make it possible to operate the magnet in a persistent-current mode, which can drive the magnet without external power-supply. However, the 1020 MHz NMR magnet has been designed and operated in a power-supply-driven mode since the superconducting joint technique has not been developed sufficiently for the joint between LTS and HTS. In this study, we have fabricated the superconducting joints between NbTi and Bi2223 wires using Bi-added PbSn solders with *in-situ* sheath-dissolution technique without a removal process of sheath materials, as shown in Fig. (a) [2]. The joint exhibited a homogeneous morphology, and showed high critical current above 200 A under self-field and 50 A under magnetic field of 5 kOe at 4.2 K as presented in Fig. (b). The evolution of this technology will introduce the possibility to realize HTS/LTS magnets with the persistent current operation.

[1] K. Hashi et al., *J. Magn. Reson.* **256**, 30 (2015).
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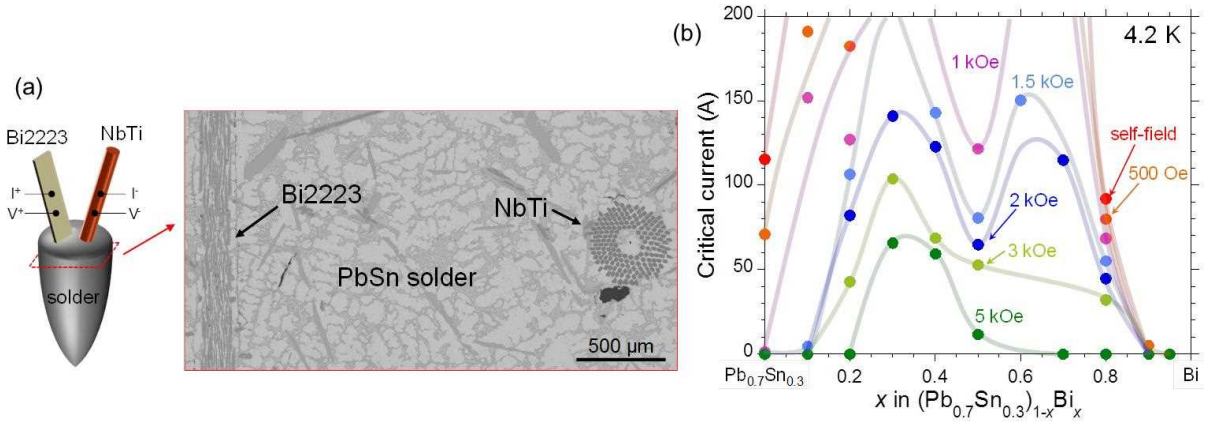

Keywords: Joint, Solder, Magnet

WBP5-5

Recent Progress on Superconducting Joint Technique of MgB_2 Wires at Korea University

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This study presents a superconducting joint technique for the development of MgB_2 magnetic resonance imaging (MRI) magnets. The MgB_2 superconducting joint was fabricated by a powder processing method using Mg and B powders to establish a wire–bulk–wire connection. The joint resistance measured using a field-decay method was $< 10^{-14}$, demonstrating that the proposed joint technique could be employed for developing “next-generation” MgB_2 MRI magnets operating in the persistent current mode.

Keywords: MgB2, Field-decay method, Superconducting joint, MRI