

PL4-INV

Development of (Ba,K)Fe₂As₂ tapes and wires in Japan

*Hiroaki Kumakura¹

National Institute for Materials Science¹

Among various iron-based superconductors, (Ba,K)Fe₂As₂ (Ba-122) are potentially useful for high field applications due to their high upper critical fields of over 50T and small anisotropy. However, enhancements of superconducting properties are still needed to boost the successful use of Ba-122 in such applications. In this presentation I will review recent progress of Ba-122 conductors in Japan.

Ba-122 tapes and wires are prepared by *ex situ* PIT method using Ag as a sheath material. The application of uniaxial pressing at the final stage of deformation significantly enhances J_c values. However, the uniaxial pressing is not a practical method for long tape fabrications. Furthermore, the Ag sheath is completely annealed and becomes very soft after the heat treatment. In order to solve these problems a combination of new sheath structure of stainless steel(SS) and Ag-Sn alloy double sheath are used. The highest J_c value of SS/(Ag-Sn) double sheathed tapes reaches $1.4 \times 10^5 \text{ A/cm}^2$ in 10 T, 4.2K for cold pressed tape. Even for rolled tapes, the J_c reaches to the practical level of 10^5 A/cm^2 in 10T. More interestingly, the heat treatment temperature can be greatly reduced for these double sheathed tapes.

Recently ~1m long Ba-122/SS/(Ag-Sn) double sheath tape with fairly uniform J_c distribution was fabricated. Bending tests of the double sheath tapes were also carried out. J_c started to decrease at the bending diameter of 30mm which corresponds to bending strain of ~0.17% in Ba-122 layer. These results demonstrate that the double sheath is promising for making long Ba-122 tapes for high magnetic field applications.

Superconducting joints for Ag sheathed mono-filamentary Ba-122 tapes were fabricated. Two wires were inserted into Ag-Sn alloy tube from both ends, uniaxial pressure was applied to the joint and the joint was heat treated. J_c at the joint was $1.7 \times 10^4 \text{ A/cm}^2$ at 4.2K and 10T.

Generally, round wire superconductors are more useful than tape conductors. However, Ba-122 round wires show much lower J_c values than the tape conductors due to lower Ba-122 mass density. Application of hot isostatic pressing(HIP) is effective in improving mass density and J_c values. However, the J_c of HIP processed wires still remains low level compared to the tape conductors. Further improvement of J_c capacity is required for Ba-122 wires.

Keywords: mass density, sheath material, critical current density, superconducting joint