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Wed-Af-Po3.21-05 [71]: Fabrication of new internal tin Nb3Sn wire using Sn-Zn alloy as Sn core

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Nb_3Sn superconductor is expected to play a vital role even for next generation high field applications. However, the J_c is approaching to be fully optimized in terms of cross sectional layout and heat treatment condition. Therefore, some drastic solutions are needed for further improvement in J_c.
We have been studying the effect of the element addition to the matrix in internal tin (IT) Nb_3Sn wire. One of the attractive additive elements is Zn. We have revealed so far that Zn promotes the Nb_3Sn layer synthesis. On the other hand, Ti is well known to be an effective additive to promote Sn diffusion, and enhance B_{c2} and J_c. In our conventional brass matrix IT wires, Ti is used to be doped to Sn cores because of the simplicity of the doping method. That also contributed to increase the hardness of Sn cores. However, our previous study revealed that a Sn-Ti intermetallic compound layer is formed during the pre-annealing for Sn/Cu mixing in case that Ti is doped to Sn cores, which seems to avoid smooth outward Sn diffusion. Therefore, it would not be preferable to dope Ti to Sn cores.
The workability of IT wire is actually also an important issue, because, in IT wires, quite soft Sn cores are contained in the composite together with relatively hard Nb, which causes unbalance of the hardness across the composite. This ununiformity was one of the main reasons for wire breakages in our laboratory-scale brass IT wires.
From these reasons, we attempted to fabricate new IT wires using Sn-Zn alloy as central Sn cores, and doping Ti to the matrix and Nb but not to Sn cores. In this study, the drawability of the new IT wire was evaluated. Furthermore, we study Sn, Ti and Cu diffusion behaviors during the heat treatment in detail through microstructural and microchemical observations. The microstructure is correlated with the J_c performance.

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