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P3.081 Development of the bronze processed Nb3Sn wires using various Cu-Sn-In ternary alloy matrices

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The degradation of transport current property by the high mechanical strain on the practical Nb3Sn wire is serious problem to apply for the future fusion magnet operated under higher electromagnetic force environment. Therefore, increase of the mechanical strength on Nb3Sn wire is the most important research subject. Recently, we approached to the solid solution strength process on the ternary Cu-Sn-Zn matrices for the high mechanical strength bronze processed Nb3Sn wires. We found that the mechanical strength of the Nb3Sn wire was improved with increasing solid solubility of Zn as a solute element. On the other hand, there was also a trade-off relationship between the Sn and Zn composition in the bronze matrix. In order to optimize the solid solution process for the high strengthened Nb3Sn wire, a ternary bronze alloy containing Indium (In) as a solute element (Cu-Sn-In), which is thought to be more effective solute element than Zn was casted as a solid solution strengthened bronze material.
We fabricated the bronze processed Nb3Sn wires using various Cu-Sn-In matrices. In these wires, In remained into the matrices after the Nb3Sn synthesis, and then the Vickers hardness of the Cu-Sn-In matrices after the Nb3Sn synthesis heat treatment was higher than those of the conventional bronze and Cu-Sn-Zn matrices. It is suggested that indium element act more effectively as the solute element for solid solution strength process compared with zinc element and it may contribute to further mechanical strengthening of Nb3Sn wire.
In this study, effect of In element as the solute element on microstructure and superconducting properties of the bronze processed Nb3Sn wires using various Cu-Sn-In matrices was mainly investigated.
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