

Effect of Zn addition on Nb₃Sn layer formation in Nb/Cu-Sn-Ti diffusion reaction

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Abstract: The enhancement of the characteristics of Nb₃Sn superconducting wire is essential for the development of magnets for the fusion reactors like ITER and DEMO. As already known, the Ti-doping has a great effect for enhancing the upper critical magnetic field (B_{c2}). Ti is commonly doped into Nb or Sn-alloy in practical Nb₃Sn superconducting wires, and it would be preferable to add Ti to Sn side from the manufacturing perspective. However, Ti-doping on Sn site could cause some undesirable stable compound layers at the interface with Nb as a diffusion barrier for Sn during the Nb₃Sn layer formation. Finding a new reaction route that destabilizes this compound layer is a challenging theme in Nb₃Sn formation process, which leads to dramatic improvement in Sn diffusion when Ti is doped to Sn core. Nevertheless, there are few studies up to the present that fundamentally investigate this aspect. In the previous studies, it has been reported that Zn is effective for promoting Nb₃Sn layer formations. Therefore, in this study, we fabricated some specific diffusion couples of Nb/Cu/Sn with different combinations of Ti and Zn doping to Cu and Sn, and investigated their diffusion reaction behaviors in Nb₃Sn layer formation.

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