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Microstructure and superconducting properties of Hf,Ta-added bronze-route Nb3Sn wire

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Hf addition together with Ta to the Nb cores results in significant refinement of the Nb3Sn grain morphology, leading to large enhancement of flux pinning characteristics. That is why it attracts much interest in the field of Nb3Sn wire development. This effect has been confirmed so far for the internal tin Nb3Sn wires. However, this effect should be naturally expected also for the bronze route Nb3Sn wires. Especially in the application to the next generation fusion magnet DEMO that requires high stress tolerance as well as good critical current density for the strand, the Nb3Sn strand with Hf addition can be a better candidate for DEMO magnet.
In this work, we prepared and tested bronze route Nb3Sn wires with single core configuration to investigate fundamental effects of Hf addition on the microstructure and superconducting properties of bronze route Nb3Sn wires. Nb-4at%Ta-1at%Hf was used as parent Nb core, which was made by arc-melting. Cu-14wt%Sn was made by an induction heating furnace and used as the matrix. As a reference sample, we also prepared a wire with configuration of Cu-14wt%Sn-0.2wt%Ti/Nb. As a result, refinement of grain morphology of Nb3Sn layer was confirmed in the sample with Hf and Ta addition.

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