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Study on the Optimum Microstructure of High Jc Nb3Sn Wire after medium heat treatment

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Nb3Sn wires are wildly used in high-field (> 10 T) magnets and have great potential value in the next 20 years. Internal-tin Nb3Sn strand has been developed by many methods for the future fusion reactor, high energy accelerator and so on. Increasing the critical current density of Nb3Sn wire, reducing the use amount of wire in magnets and reducing the price are important ways to promote the industrialization and mass application of Nb3Sn wire. The Optimum Microstructure of High Jc Nb3Sn Wire after medium heat treatment is: (1) there is no Cu6Sn5 phase in the center of the sub-element; (2) there is no Cu-Nb-Sn phase near the inner Nb filament layer; (3) Cu-Nb-Sn phase is uniformly distributed in the all areas between Nb filaments. The above microstructure state is critical to improve the current density of the wire. After medium heat treatment, morphology of wire is improved obviously. The diffusion of Sn reaches 100% and there is no obvious Cu-Nb-Sn phase aggregation. The content of Cu6Sn5 phase decreased to 20%. Thus, in the wire after final heat treatment, there is no coarse grain in the sub-elements. The critical current of the wire increases from 540A to 623A and the residual resistance ratio increases from 66 to 139.

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