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## **The effects of different heat treatments on the performance of Internal-tin Nb<sub>3</sub>Sn rectangle wires**

In order to meet the different market demands for superconducting materials under high magnetic field, it's particularly necessary to explore and research superconducting materials related to Nb<sub>3</sub>Sn. Three different specifications of internal-tin Nb<sub>3</sub>Sn rectangle wire have been developed by multi-pass drawing, twisting, and rolling. This article researches the influence of different heat treatment on the microstructure and performance. The heat treatment schedule were carried out as following: 210 C×50h/340 C×25h/450 C×25h/575 C×100h/650 C×100h/125h/150h/175h/200h, with a ramp rate of 5 C/h. The samples were done the low temperature performance test. Observation of microstructure of rectangle wires, it can be seen that the center 7 sub-elements were deformed from hexagon to rectangle. With the increase of the rolling deformation degree, the strands have worse uniformity. Due to the rolling deformation, a small amount of larger Nb filaments were existed and the spaces between the Nb filaments were almost zero. The n value of rectangle wire is smaller than that of the round wire for the worse defomation. With the increase of heat treatment time, the critical current densities increases with the Nb<sub>3</sub>Sn reaction layer grew gradually and the unit volume hysteresis loss also increase caused by the bridge phenomenon happened in part of filaments of adjacent sub-elements. The microstructure of the strand was investigated by a scanning electron microscope. The average grain size is about 100-120 μm after different heat treatments.

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