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Effect of heat-treatments on the Jc of NbTi superconductor for high magnetic fields

The critical current density of NbTi superconductors is affected by a complex schedule of heat-treatments and strain. The optimization of temperature, time and final strain are good for obtaining appropriate quantity and size of the α-Ti precipitates. In this paper, a superconductor with 3366 filaments and 1.6 Cu/Sc ratio was designed and high homogeneity Nb47Ti alloy was applied for the fabrication of the NbTi superconductors. Different heat-treatment schedules varied in temperature, time and strain were carried out on NbTi strand samples. The critical current of these samples were tested at 4.2 K under different magnetic fields ranging between 7 to 9 Tesla. The following results are obtained: the appropriate temperature for gaining fine Jc in high magnetic fields is ranging between 400℃ to 480℃ and the Jc will decrease with temperature above 480℃; the optimal final strain for the NbTi samples was about 5.0; it was a better way to get optimal critical current density that pre-aged with low temperature and short time and combined with high temperature and short time ageing. The optimal critical current density could reach 726 A/mm2 at 9 T and 4.2 k.

Key words: heat-treatment, critical current density, NbTi superconductor.

Authors: Ms YANG, Fan (Western Superconducting technologies co.,ltd.); Mr LI, Jianfeng (Western Superconducting technologies co.,ltd.); Mr LIU, Jianwei (Western Superconducting technologies co.,ltd.); Mrs HOU, Jing (Western Superconducting technologies co.,ltd.); Mr YAN, Lingxiao (Western Superconducting technologies co.,ltd.); Mr LIU, Weitao (Western Superconducting technologies co.,ltd.); Mr LI, Yonghua (Western Superconducting technologies co.,ltd.)

Presenter: Mr LI, Yonghua (Western Superconducting technologies co.,ltd.)