



Contribution ID: 694

Type: **Poster Presentation**

## **Tue-Mo-Po2.13-06 [113]: Study on High $J_c$ and Low AC Losses NbTi/Cu5Ni Superconducting Wire for HIAF Magnets during recently years in WST**

*Tuesday 24 September 2019 08:45 (2 hours)*

The High Intensity Heavy Ion Accelerator Facility (HIAF) is a new engineering project proposed by Institute of Modern Physics of China. Superconducting magnets will be used as part of the accelerator magnets. When operating at fast-pulsed cycled mode, the superconducting cable will dissipate power (AC loss), which affects the stability of magnet. The main contribution of the AC losses in superconducting wire are hysteresis loss and eddy current losses. Fine filaments design can reduce the hysteresis loss and a resistive inter-filamentary matrix can reduce the inter-filamentary eddy current losses. During recently years, WST has developed several types of superconducting wires with the matrix of CuNi alloy for HIAF project successfully. NbTi/Cu5Ni superconducting wires with filaments number of 10080, 12960, 23760, 36720 and 44064 were designed and fabricated by double stacking method. The microstructure and influence of aging heat treatment on the critical current density, hysteresis loss and break times of NbTi/Cu5Ni superconducting wire were presented in this paper. By reducing the Cu/Sc of sub-elements and improving the Cu shell thickness of final billet, the deformation of outer filament is relatively good, which is helpful to the improvement of critical current density and the decrease of hysteresis loss. Critical current density of six designed wire is between 2600 and 2700 A/mm<sup>2</sup> and n value is between 35 and 45 at 5T&4.2K, which demonstrates that no filament breakage occurs in the wire. The Cu5Ni alloy is considered as the inter-filament matrix to reduce inter-filament coupling currents loss. When the filament number increases from 10800 to 44064 and diameter of NbTi filament reduces from 4.5 to 2.5 $\mu$ m, the hysteresis losses reduces from 42.8 to 17.3 J/cm<sup>3</sup> at  $\pm$ 3T. The average wire length of six designed wires are more than 2000m, which indicates that WST have the ability of mass production. After 5 years investigation on this type of wire, WST have well obtained the design and fabricated technique and can completely satisfy the requirement of HIAF magnets.

**Primary author:** GUO, Qiang (WST)**Co-authors:** LI, Jianfeng (Western Superconducting Technologies Co., Ltd.); Dr LIU, Jiangwei (WST); Ms YAN, Kaijuan (WST); Prof. ZHANG, Pingxiang (WST); Dr WANG, Ruilong (WST); Prof. LIU, Xianghong (WST); Dr QIN, Xing (WST); ZHU, Yanmin (WST); Prof. FENG, Yong (WST)**Presenter:** GUO, Qiang (WST)**Session Classification:** Tue-Mo-Po2.13 - Low Tc Wires and Cables