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## **Characterization of an internal cooling high temperature composite superconductor with REBCO for large scale energy storage applications**

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High-temperature superconducting magnetic energy storage systems (HTS SMES) have attracted significant attention for fast response and ensure a reliable power supply. However, the current carrying capacity of single superconducting tape often meets limitation for the large scale energy storage for HTS SMES applied in the power grid. Therefore, a composite superconductor with inherent helical cooling tunnel and kA class current carrying ability is proposed for large scale HTS SMES by using REBCO. The magneto-thermal characteristics of this internal cooling composite superconductor are analyzed by using a computer program on the basis of FEM considering the influence of anisotropy in magnetic field. A 1.5 m length, high temperature composite superconductor demo is manufactured in China Electric Power Research Institute (CEPRI). The critical current experimental system with a 3 kA DC current power source and a high-precision Digital Data Acquisition (DAQ) system have been set up to investigate the current carrying ability of a straight and a bending composite superconductor demo in LN<sub>2</sub>. The results show that critical current of HTS composite superconductor consisted of 4 REBCO tapes can achieve 830 A at 77K self-field and the experimental I-V curve of each REBCO tape in the composite superconductor is not uniform because of the influence of anisotropy. When the HTS composite superconductor is bending, its critical current is 93.75% of the straight HTS composite superconductor. And the design method and the proposed experimental system are proved to be effective as well.

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