Experimental Research of AC Ripple Losses in A HTS Current Lead of A Magnet

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Background

In the circumstances for the bulk transmission of current lead in a magnet, HTS DC cables used as current leads for the magnets has great advantages. However, the AC loss is one of the important parameters of HTS DC cable and it has strong effect on its stability and operation cost. In this paper, we measured AC ripple losses of HTS tapes and the power cable. Moreover, the conclusion of the relation between AC losses and the power frequency was made.

Objectives

- DC currents with AC currents of different amplitude and frequency
- The AC ripple losses was measured.

Methods

Experimental Setup

An experiment was set-up at North China Electric Power University, using the parallel connection of a DC source and an AC source whose magnitude and frequency could be adjusted. An adjustable capacitance was used in case that the DC current circulated to the branch of the AC current.

Experimental Procedures

At the DC current of 55A, we increased the amplitude of the AC current from 5A to 20A, Thus the total current was from 60 - 75A.

Mechanical and Resistivity Characteristics

I_{DC}=60A 2.5mm*0.18mm  I_{DC}=45A

AC losses at I_{DC}=45A, and AC current at frequency of 50Hz, 150Hz, 250Hz, 350Hz

AC losses at I_{DC}=55A, and AC current at frequency of 50Hz, 150Hz, 250Hz, 350Hz

AC losses at the same total current but different DC and AC current component.

Conclusion

- AC losses increased with the amplitude of AC currents at the fixed DC current.
- The frequency of AC current did not have much more influence to the AC losses. (The frequency range is from 50 to 350Hz.)
- When the DC current and the magnitude of the AC ripple current approach to the critical current, AC losses increased remarkably.

Results

- I_{DC}=60A 2.5mm*0.18mm
- I_{DC}=45A

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