AC Transport Loss Characteristic of an MgB_2 Superconducting Tape

Kwang Myoung Park[a,*], Dong Yeon Jeong[a], and Kyung Woo Ryu[b]
[a]*Duksung Co.,LTD, Korea,*
[b]*Chonnam National University, Korea*

The MgB_2 superconducting wire is likely to be applicable to large-scale power engineering devices such as fault current limiters, power transmission cables, transformers, and rotating machines because it has easier fabrication process in comparison with other low temperature superconductors, i.e. NbTi and Nb_3Sn superconductors. However, alternating magnetic field in these devices causes electromagnetic energy dissipation (AC loss) despite zero resistance of a superconductor. The dissipated heat must be removed from the low temperature vessel by a refrigerator. Thus reduction of the AC loss is the most important in commercialization of the superconducting devices. Its characterization and clarification of causes that influence the AC loss are essential.

In this work, we first prepared an about 300 mm long MgB_2 tape wound around a metallic former with a diameter of 100 mm. Diagonal voltage lead, which is well proved in our previous study, is used to detect the entire loss voltage of the MgB_2 tape. The AC transport loss was calculated by using $I_pE_p/(2f)$, where I_p is the peak transport current, E_p the peak loss component of the electric field at fundamental frequency, and f the frequency. We investigated AC transport current loss (self-field loss) of the MgB_2 tape for various AC transport currents, temperatures, and frequencies. The results show that measured AC transport losses are very large compared to the calculated ones based on the Norris's elliptical model, which fits well with losses measured for a Bi-2223 high temperature superconducting tape.

Keywords : AC transport loss, MgB_2 wire, superconducting power engineering device.

Acknowledgement

This research was supported by a grant (R-2006-1-248) from Electric Power Industry Technology Evaluation & Planning (ETEP), Republic of Korea.