

Design and Experiment of Inter-phase Transformer for the Optimized Operation of HTS Cable

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Since high temperature superconducting (HTS) cables are, generally, composed of multi-layer conductors, they are apt to be occurred non-uniform current distribution among the layers. These cause to increase AC loss, which is in proportion to magnitude of transporting current. To reduce this inevitable loss, winding pitches are adjusted, so that the impedance of each layer can be equal. Through this process, the uniform current distribution can be accomplished, however, the problems of difficulties of design and possibility of defect during the winding process still remain. On the other hand, Inter-phase transformer (IPT) is a device that is known to control the impedance among branches using magnetic shield effect. In this study, IPT was designed and tested to make the current distribution uniform among the layers in HTS cable conductor. HTS tapes of 115A I_c were used to increase current capacity. In addition, HTS cable conductor composed of 2 layers in which HTS tapes are laid on the former straightly. Applying various magnitudes of currents through IPT, we investigated the current sharing state in HTS cable conductor. As a result, the IPT made the impedance equal among the layers successfully, and the applied current was distributed uniformly. In conclusion, application of IPT to the operation of HTS cable was thought of as a useful method to reduce AC loss.

keywords : HTS cable, IPT, current distribution, AC loss