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# Modeling of AC loss characteristics under electromagnetic conditions in High-temperature superconducting cable

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High-temperature superconducting (HTS) tapes in a superconducting cable are twisted and stacked as multi-layer. The superconducting tapes are exposed to a combined magnetic field of the circumferential magnetic field created by the inner layers and the longitudinal magnetic field created by the twisted outer layers. The AC loss in superconducting tapes under HTS cable electromagnetic conditions is determined by the amplitude of the transport current, the amplitude and direction of the magnetic field, and the twist pitch of the HTS tapes.
Previously, the AC loss characteristics under these conditions were investigated. In this experiment, we reproduced the electromagnetic condition of one layer of the HTS cable in which the circumferential magnetic field was applied to the inside of a cylindrically twisted HTS tape by the transport of current through it, and the longitudinal magnetic field was provided by a solenoid coil. Under these conditions, AC losses were measured by a calorimetric method at HTS tapes twist angles of 5 to 20°. In this study, we modeled the AC loss under electromagnetic field conditions in the superconducting cable based on these data. In general, the HTS tape has the lowest loss when the magnetic field is parallel to the tape axis and the highest loss when it is perpendicular to the tape axis. Based on these characteristics, we modeled the AC loss by focusing on the maximum and minimum values of the loss. This model allows easy determination of the losses in each layer of the superconducting cable for minimizing the AC loss load of the superconducting cable.

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