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Tue-Af-Po2.19-02 [43]: Experimental investigation on AC loss characteristics under HTS cable electromagnetic conditions

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In a high-temperature superconducting (HTS) multi-layer AC cable, the HTS tapes of one layer are twisted cylindrically, an AC transport current is provided, and the cable is exposed to an AC magnetic field produced by the other layers. The magnetic field consists of a circumferential magnetic field and a longitudinal magnetic field. The circumferential magnetic field is produced by a transport current in the inner layer. The longitudinal magnetic field is produced by a transport current in the twisted outer layers. In a previous study, we measured the AC losses in each layer of a three-layer twisted HTS cable using a calorimetric method. This cable could change the AC transport current balance and enabled the control of the circumferential and longitudinal magnetic fields. The magnetic field of each layer behaved as an external magnetic field for other layers. The amplitude and direction of the magnetic field influence the AC loss characteristics; when the magnetic field is parallel to the axis of the HTS tapes, the AC losses are smaller than when it is exposed in other directions. In this study, we assumed one layer of the HTS cable and measured AC losses in twisted cylindrical samples with an AC transport current and external circumferential and longitudinal magnetic fields. For the circumferential magnetic field, we placed non-twisted stacked HTS tapes cylindrically with a transport AC current. The longitudinal magnetic field was generated by a capper solenoid coil. We could control the amplitude and direction of the composition magnetic field with the balance. We measured AC losses using the calorimetric method, similar to our previous study. We investigated the influence of the twist pitch, amplitude, and direction of the magnetic field on the AC loss characteristics.

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