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## **Tue-Af-Po2.19-08 [49]: Effect of Dynamic Resistance on AC loss in a Conductor-on-round-core Cable**

*Tuesday 24 September 2019 14:00 (2 hours)*

**Abstract**—Conductor-on-round-core (CORC) cable, which is helically wounded by YBCO coated conductors, has become a promising candidate conductor for high temperature superconducting (HTS) applications, such as superconducting magnets and electric machines. Understanding the mechanism and magnitude of AC loss is extremely critical for the design of CORC cable. Dynamic resistance has been observed in HTS coated conductors when they transport DC current and expose to an AC magnetic field. AC loss in this state includes the magnetization loss and the dissipative loss generated by dynamic resistance.

In this paper, a 3D finite element method based on T-A formulation is built to calculate the dynamic resistance and AC loss in a CORC cable, which is carrying a constant DC current under an AC magnetic field up to 100 mT. Subsequently, we investigate the relationship between dynamic resistance and the magnitude of applied current and magnetic field. Then how the frequency of AC magnetic field influences the dynamic resistance is analyzed. The effect of interaction between dynamic resistance and AC external field on AC loss is also studied. Finally, the characteristics of dynamic resistance and AC loss mentioned above are all experimented to compare with the modeling. Dynamic resistance is generated when the magnitude of external field exceeds the threshold and increases with the continue increasing of the magnitude of AC external field. The result shows that there is a slight dependence of dynamic resistance on the frequency of AC magnetic field when the applied current is much less than the critical current. AC loss reaches to the maximum at threshold field and then decreases with the increasing of background field.

**Index terms**—CORC cable, Dynamic resistance, AC loss

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