Investigation of Power Dissipation Mechanisms in Coated Conductors at High Current Densities Based on Ultra-Fast Pulsed Current Measurements

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Abstract - In this contribution, we report and discuss the physical meaning of pulse current measurements carried out on coated conductors (CCs) consisting of a superconducting YBCO film deposited on a Hastelloy substrate and coated with a thin metallic layer. The high current (up to 1000A) and short duration pulses (from 10 μs to 1 ms) have allowed us to determine the current-voltage characteristics of two different samples in a situation near that of zero injected energy, and therefore remove the bias resulting from the temperature rise during the measurement. The characteristics obtained show a flux creep region and two linear regimes. The first linear regime is the flux flow regime. In this regime, we show that the vortex velocity is a constant that depends on the metal film resistivity. The second linear regime is ohmic and his origin is less clear. We propose models describing both linear regimes, that are in agreement with the measurements. Finally, we discuss the consequences of these results for the applications of the coated conductors in devices for power systems, especially fault current limiters and power transmission cables.

Index Terms - Fault current limiters, Flux flow, High-temperature superconductors, Resistivity measurement, Superconducting tapes, Yttrium compounds.

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