Computation of Losses in HTS Under the Action of Varying Magnetic Fields and Currents

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Abstract - Numerical modeling of superconductors is widely recognized as a powerful tool for interpreting experimental results, understanding physical mechanisms and predicting the performance of high-temperature superconductor (HTS) tapes, wires and devices. This is especially true for ac loss calculation, since a sufficiently low ac loss value is imperative to make these materials attractive for commercialization. In recent years, a large variety of numerical models, based on different techniques and implementations, have been proposed by researchers around the world, with the purpose of being able to estimate ac losses in HTSs quickly and accurately. This article presents a literature review of the methods for computing ac losses in HTS tapes, wires and devices. Technical superconductors have a relatively complex geometry (filaments, which might be twisted or transposed, or layers) and consist of different materials. As a result, different loss contributions exist. In this paper, we describe the ways of computing such loss contributions, which include hysteresis losses, eddy current losses, coupling losses, and losses in ferromagnetic materials. We also provide an estimation of the losses occurring in a variety of power applications.

Index Terms - ac losses, numerical modeling, hysteresis losses, coupling losses, eddy current losses, magnetic materials.

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