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AC loss simulation in a HTS 3-phase 1 MVA transformer using H formulation

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One of critical issues for HTS transformer application is AC loss in the HTS windings. Accurate prediction of AC loss is therefore very important for the HTS transformer application. In this work, we present AC loss simulation results employing the H-formulation and homogenization method for a HTS 1 MVA 3-phase transformer demonstrated by Robinson Research Institute in New Zealand. The high voltage (HV) windings are composed of 24 double pancakes per phase wound with 4 mm-wide YBCO wire. Each double pancake coil has 38 ¼ turns. The low voltage (LV) winding for each phase consists of a 20 turn single-layer solenoid wound with 15/5 (15 strands of 5 mm width) Roebel cable. The numerical method was first verified by comparing numerical and experimental AC loss results in two coil assemblies composed of two and six double pancake coils. The numerical AC loss result for the transformer was compared with measured AC loss as well with the numerical result obtained using the minimum magnetic energy variation (MMEV) method. The disagreement between the numerical AC loss result in this work and experimental result as well as the numerical result using MMEV at the rated current is less than 20 %. The same numerical method can be applied to calculate AC loss in larger rating HTS transformers.

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