

Design of a 1MVA Single-Phase HTS Power Transformer

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In this paper, a design and 3-D electromagnetic analysis of 1MVA transformer with BSCCO-2223 high T_c superconducting (HTS) tapes are presented. The rated voltages of each sides of the transformer are 22.9 kV and 6.6 kV, respectively. The winding of 1MVA HTS transformer is consisted of double pancake type HTS windings, which have advantages of insulation and distribution of high voltage, and are cooled by subcooled liquid nitrogen of 65K. Four HTS tapes were wound in parallel for the windings of low voltage side. In order to distribute the currents equally in each conductor, the four parallel conductors are transposed. In the design of 1MVA HTS transformer, a shell type core made of laminated silicon steel plate is chosen, and the core is separated with the windings by a cryostat with a room temperature bore. The cryostat made of non-magnetic and non-conducting material and a liquid nitrogen sub-cooling system is designed in order to maintain the coolant's temperature of 65K. For electromagnetic analysis of 1MVA HTS transformer, a 3-dimensional finite element method is used. The maximum perpendicular component of magnetic flux density of pancake windings is 0.24T. And through analyzing the magnetic field distribution, an optimal winding arrangement of 1MVA HTS transformer is obtained.

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