

Conceptual Design of a High Temperature Superconducting Transformer with on Load Tap Changer

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HTS superconducting machines are being developed by one of 21st Century Frontier R&D Programs in Korea. Center for Applied Superconductivity Technology (CAST) takes charge of the program and is supporting to develop HTS transformers, fault current limiters, motors, cables and coated conductors. The HTS transformer has a lot of advantages such as energy saving and operating cost reduction due to the high efficiency. The final goal of CAST program for the HTS transformer is to develop a 3 phase 100 MVA HTS power transformer. For this target, the program for the transformer is composed of 3 stages. We have fabricated a 1 MVA HTS transformer in the first stage and the second stage is in progress now.

We have proposed 100 MVA, 3 phases, 154 kV class HTS transformer substituting for 60 MVA conventional transformers. The power transformer of 154 kV class has a tertiary winding besides primary and secondary windings. So the HTS transformer should have the 3rd superconducting winding, it makes the cost of the HTS transformer high and the efficiency low. Further more we considered On Load Tap Changer (OLTC) in HTS power transformer. OLTC equipment requires for fitting to a power transformer by which the voltage ratio between the windings can be varied while the transformer is on load. And the core is separated from the windings by a cryostat with a room temperature bore. The operating temperature of HTS power transformer will be 65 K with sub-cooled liquid nitrogen. Cooling systems were designed for forced circulation method. We analyzed the electrical characteristics of the HTS transformer such as magnetic stress, AC loss and operating temperature, and proposed a suitable HTS transformer model for future power distribution system.

Keywords : HTS transformer, OLTC

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