

Quench Protection of DI-BSCCO Coil

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Abstract

1. Introduction

Generally, as HTS wires have a very slow NZP, hotspots easily occur in a coil and result in the degradation. To prevent the degradation, it is important to rapidly decay an operating current after detecting a quench. However, a large scale superconducting motor such as 20MW motor has an inductance as high as 100 H, the coil and the wiring need to have a withstand voltage as high as thousands of volt to rapidly decay the operating current. Then we made the mini coils which simulated the coil for a large scale motor to investigate the condition of protecting the coil without degradation by parameterizing the current decay time constants and the quench detecting voltages. In addition, we made and investigated a full-scale polar coil for a 20MW motor. This paper shows the results.

2. Experiment

The mini coils wound of DI-BSCCO tape are double pancake coils. We stacked four mini coils. The mini coils were cooled by a refrigerator and the temperatures were kept by controlling the heater power. The operating current was 200A, the quench detecting time was 0.1 second and we used a balance circuit to detect the quench. To generate the quench we raised the temperatures of the mini coils gradually. If a quench was detected, the operating current was decayed exponentially. After that we measured the I-V characteristic. By comparing it with the initial I-V characteristic we investigated the existence of the degradation.

3. Result

When the current decay time constant is shorter, the coils can be protected with higher detecting voltages. Even if the heat generation is high, DI-BSCCO coil are found to be very stable.

4. Acknowledgement

This study was supported by Japan Science and Technology Agency.

Keywords (Index Terms) — HTS tapes, high-field magnets, rotating machines, protection, BSCCO