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A Study on Thermal and Electrical Stabilities of GdBCO Coils Impregnated with Epoxy Composites Using Surface-Treated Carbon Nanotube Fillers

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Recently, there have been sustained efforts to develop novel epoxy composites including various fillers for improving the physical properties of the epoxy-impregnated superconducting coil. Among the various filler materials, carbon nanotubes (CNTs) have emerged as one of the promising candidates because of the high thermal conductivity as well as the superior mechanical strength. However, achieving the desired thermal and mechanical properties of CNT/epoxy composites is difficult due to poor dispersion of CNT fillers in epoxy resins. Therefore, the uniform dispersion of CNTs should be obtained through surface treatments such as acid treatment and amine treatment, to enhance the physical properties of superconducting coils impregnated with epoxy composites using the CNT fillers. In this study, the thermal and electrical characteristics of GdBCO coils impregnated with epoxy composites containing surface-treated CNT fillers were evaluated through the thermal quench, over-current, and repetitive cooling tests. In addition, the degree of dispersion of the CNT fillers in the epoxy resin was examined through scanning electron microscope (SEM) analysis.

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