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Performance of Vacuum Epoxy Impregnated 2G-HTS Undulator Magnets

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Recent studies on prototype undulator magnets showed that second-generation high temperature superconducting (2G-HTS) tapes are suitable for use in undulators to enhance their performances substantially. However, providing sufficient mechanical stability and rigidity to the magnet windings have remained a challenge. Vacuum epoxy impregnation is a widely employed technique to improve the mechanical properties of magnet windings. So far, most of the impregnated 2G-HTS coils/magnets showed some degree of degradation after the first cold cycle or subsequent cold cycles. In this study, we developed a vacuum impregnation technique that does not degrade the performance of the 2G-HTS undulator prototype magnets even after repeated cold cycles. The results showed that in order to prevent degradation, either the epoxy thickness around the coil stack needs to be kept small or a bumper layer between the magnet winding stacks and the epoxy needs to be introduced. Microstructure images of vacuum impregnated coil packs showed uniformly spaced 2G-HTS winding layers and very thin epoxy fillings between the layers, which is important for the overall performance of the device.

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