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Persistent Current Switch with Diode Protection and Superconducting Joint for a 5 T NbTi NMR Magnet

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A nuclear magnetic resonance (NMR) magnet system equipped with a persistent current switch (PCS) operates efficiently without Joule loss in persistent current mode (PCM). The superconducting joint technique and a persistent current switch (PCS) are essential to develop the PCM. In this study, we fabricated NbTi superconducting joints and measured the resistance of these joints. Based on the superconducting joint technique, we designed an NMR system in which the PCS is connected to a 5 T NMR magnet with a superconducting joint, which enabled the system to be operated in PCM at 5 T. Furthermore, we used diodes to develop active protection for the NbTi high-field magnet to protect the magnet from permanent damage resulting from quenching caused by a fast charging rate or insufficient cooling. The effectiveness of the diode protection during quench testing was investigated using the value of the Z-function obtained from the results of the quench test.

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