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Development and Performance of 65 T Fast-cooling User Magnet with Long Service Life

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Since the accomplishment of the pulsed magnetic field facility at the Wuhan National High Magnetic Field Center, a few types of pulsed magnets, such as the 40 T helical magnet, 65 T monolithic-coil magnet and 90 T dual-coil magnet, have been developed and are now in operation for scientific research. As the workhorse, the 65 T user magnets show excellent cooling performance and long service life. These user magnets have typical bore size of 21 and 23 mm. They are energized by 2 or 3 MJ capacitor bank for 50 ~ 80 ms pulse duration with crowbar circuit. For magnetization measurement, shorter pulse duration of 12 ms for field waveform with symmetrical rising and falling edge can also be produced with 1.25 MJ high reversal voltage capacitor bank. In each of these magnets, a 5 mm axial cooling channel for flow of liquid nitrogen is fabricated. The cooling time between every two 60 T pulses ranges from 30 to 50 minutes depending on the magnets and the field waveform. Since 2013, six fast cooling user magnet have been manufactured. Two of them have failed after 616 and 916 pulses with the magnetic field above 60 T. The other three have delivered 34, 618 and 817 pulses above 60 T and are still in operation. The design and experimental results of these fast-cooling magnets will be reported in this paper.

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