

Pulsed Field Facility Enhances User Capability with Introduction of Large-bore Pulsed User Magnet for Science and Industrial R&D

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Overview

A new large-bore 10 T pulsed magnet has been commissioned and entered into service at the NHMFL Pulsed Field Facility. The magnet is unique in that it operates at room temperature, and has a large 144 mm internal bore diameter. The magnet generates a 10 T pulsed field with a 10.1 ms rise time and a “1/e” decay time of 14 ms. The design objective of the magnet was to present room temperature experimental samples with a rapidly changing magnetic field to evaluate the effect of inductively coupled voltages and resulting eddy currents. (See Fig. 1 for description.)

Presently this magnet can generate temporal derivatives in the magnetic field of ~ 1570 T/s in a 1500 cc spherical volume. Potential experimental applications that this magnet can support are in biology: for example DNA transfection, metallurgy: for example solidification processes in pulsed magnetic fields, and electronics: for example reliability testing of circuits and component systems in pulsed magnetic fields, and magnetization of large components.

Summary of Magnet Performance and Initial Operations

The magnet structure was designed to accommodate metallic experiment housings subject to large acceleration loads in pulsed fields. The accelerations during a pulse corresponded to ~ 2500 G with loads in the 66 kN range.

The NHMFL Pulsed Field Facility hosted technical staff from Textron HR as its first user on this magnet. The Textron group performed component and circuit system tests to evaluate performance and reliability of flight control systems. Component testing entailed over 70 pulses during the first week of operations. This enterprise initiated collaboration between the NHMFL and an industrial partner in support of US industry.

Conclusions

A 10T large-bore room-temperature pulsed magnet is now available at the NHMFL Pulsed field facility. Future work on this system will entail enhancing the user-interface to facilitate rapid sample transfer for various scientific user applications. The development requirement for this assembly was to generate large temporal magnetic field derivatives in test samples.



Figure 1 New 10 T large-bore room temperature pulsed magnet now available at NHMFL Pulsed Field Facility. Magnet presently retrofitted to standard magnet support assembly. Magnet provides a 10 T pulse in a 144 mm bore generating temporal magnetic field derivatives as high as 1570 T/s in a 1500 cc spherical volume