

Press Release

Liquid Cryogen-Free Superconducting Magnet System

Release Date: September 16, 1999

Introduction

Cryomagnetics, Incorporated, of Oak Ridge, Tennessee, announces the successful test of a 9 Tesla, cryogen-free superconducting magnet system based on a pulse tube refrigerator (work performed under NIH SBIR Grant # 1 R43 GM59564-01). The system utilizes a new two-stage 4K pulse tube refrigerator developed by Dr. Chao Wang of CryoMECH, Incorporated, Syracuse, New York. The cryocooler is used to cool an intermediate thermal shield and HTS current leads to approximately 50K and the NbTi-based superconducting magnet to 4K. No liquid cryogens are required. This is believed to be the first commercial application of a pulse tube refrigerator for direct cooling of a superconducting magnet.

System Details

The system has a horizontal 32mm clear room temperature bore diameter through the high field region. The cryostat is a compact 17" outside diameter by 12" length. The refrigerator access tube is located on top of the system. The magnet generates a magnetic field of up to 9T with 0.1% homogeneity over a 10mm diameter volume. The

system utilizes Bi-2223 based HTS current leads that were also developed by Cryomagnetics. Cool-down time from room temperature to operating temperature is approximately 14 hours. The magnet was charged in less than one hour. After an intentional quench at 9.2T, the system recovered in temperature in approximately 3 hours.

Advancements

- **Low Vibration.** The new pulse tube has no moving cold parts. Common cryo-refrigerator systems rely on a moving displacer that transmits vibration through the cold head to the superconducting magnet system. Vibration-sensitive experiments cannot be performed with conventional cryocoolers.
- **Low Maintenance.** No moving displacers means no cold seals to maintain.
- **Low Noise.** Lack of moving parts in the cold head make for a very quiet system.
- **Low Cost.** Due to its simplicity, the pulse tube can be manufactured for less cost than common cryo-refrigeration systems.



Applications

Any application where low-cost and low-vibration are important issues. Cryomagnetics is a custom design superconducting magnet manufacturer, so it is likely a pulse tube based superconducting magnet system can be designed to individual researcher specifications. The pulse-tube cryo-refrigerator is a versatile instrument that can be incorporated into many commonly designed systems. For example, the pulse tube system can be used in liquid helium based systems to reduce or eliminate liquid helium boiloff.

CryoMECH is developing more powerful pulse-tube cryo-refrigerator systems to address the needs of the future.

Contact us for further information.