Research Matters

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Highest Ever Field for Neutron Diffraction Achieved with Split Pair Superconducting Magnet

A split-pair magnet, designed and manufactured by Oxford Instruments, has achieved the highest magnetic field available for neutron diffraction measurements.

Researchers of the Sample Environment Group at the Berlin Neutron Scattering Centre (BENSC) of the Hahn-Meitner-Institut in Berlin, Germany, have measured record fields of 17.1 T.

The new magnet uses the Oxford Instruments' 14.5 T split pair magnet, which already provides the highest fields available in the world for neutron scattering experiments. The record 17.1 T field has been achieved by adding a magnetic field booster using dysprosium pole pieces. Dysprosium, which is ferromagnetic below 85 K, has the highest known saturation magnetisation of 3.5 T. Oxford Instruments designed a top-loading sample holder insert, incorporating specially manufactured poles pieces, to provide a sample space 6.5 mm in diameter by 4 mm high. The team at BENSC then optimised the design to achieve a field enhancement of 2.51 T at the sample position and regulated temperatures between 1.8 K and 50 K.

High magnetic fields are increasingly in demand in structure investigations. Their ability to break the atomic-molecular spin coupling enables examination of the intrinsic effect of field on spin states. High fields may also be used, safely, to replicate the effect of high pressure for the examination of changes in the magnetic structural order of solids, for example for high-T_c superconductors. Starting last year at BENSC, several international research teams performed elastic and inelastic neutron scattering experiments with the split-pair magnet up to 14.5 T*. As an option, the Sample Environment Group at BENSC was able to insert an Oxford Instruments top-loading dilution refrigerator sample stick into the cryomagnet. As a result they achieved a lowest sample temperature of 35 mK at 14.5 T. Together with the 2.5 T booster option (at present for temperatures above 1 K) the research on structural order and dynamic properties of magnetic systems has extended its range of interest to new limits.

* BENSC Experimental Reports 1998 Synopsis Version 3, incorporating revisions from Professor Michael Meissner.

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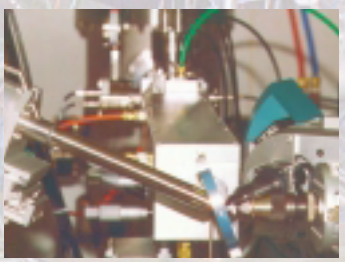

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