Poster Presentation

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Neutron scattering in static magnetic fields up to 26 T

Oleksandr Prokhnenko[1], Peter Smeibidl[1], Maciej Bartkowiak[1], Norbert Stuesser[1], Sebastian Gerischer[1], Robert Wahle[1], Stephan Kempfer[1], Karel Prokes[1], Mark Bird[2], Bella Lake[1]

[1]*Helmholtz-Zentrum Berlin, Berlin, Germany,* [2]*National High Magnetic Field laboratory, Tallahassee, United States*

E-mail: prokhnenko@helmholtz-berlin.de

Helmholtz-Zentrum Berlin (HZB) operates the medium flux research reactor BER II and the third generation synchrotron source BESSY II. HZB is known for providing an outstanding sample environment, especially high magnetic fields and low temperatures, which is available for both internal and external users. In this contribution we present the latest achievement in this field - High Magnetic Field Facility for Neutron Scattering, which was recently launched at HZB. This facility allows combining neutron scattering with continuous magnetic fields as high as 26 T and temperatures down to 0.65 K (at present) and 0.1 K (in near future).

The application of high magnetic fields is a powerful method for revealing the complex behavior in modern materials. In combination with microscopic probe such as neutrons it provides a direct access to static and dynamic correlations in matter. Recently HZB in collaboration with the National High Magnetic Field Laboratory (USA) built a unique horizontal solenoid High Field Magnet (HFM) [1]. The magnet utilizes hybrid (resistive insert and superconducting outsert) technology and reaches 26 T at full power of 4 MW. The tapered inner coil allows neutron-scattering to detectors up to +/-15° off the beam axis. Furthermore the magnet can be rotated by an additional 15° to access a larger reciprocal space region.

Neutron scattering in high fields is performed using the dedicated Extreme Environment Diffractometer (EXED) [2]. EXED uses time-of-flight (TOF) polychromatic technique which compensates very limited angular access available in the HFM. TOF technique combined with 15° magnet rotation provides a gapless coverage of Q-range from 0.1 up to 12 Å-1 for diffraction experiments. The low-Q range can be extended beyond 10-2 Å-1 using a pin-hole TOF Small Angle Scattering mode implemented on the instrument. In addition to the existing elastic capabilities, a direct TOF spectrometer mode was built in this year. The latter will enable inelastic neutron scattering experiments over a limited Q-range < 1.8 Å-1 with an energy resolution of a few percent and incident energies below 25 meV [3].

Since the magnet has room temperature bore, several low-temperature inserts have been developed at HZB. They include 4He-cryostat (1.5 K) with a sample rotation stage, 3He cryostat (0.65 K) and a dilution fridge (0.1 K, in fabrication).

In this contribution the overview and capabilities of the HFM-EXED facility will be presented together with the selected experimental results.

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