AN X-RAY DIFFRACTOMETER FOR THE FLORIDA SPLIT COIL 25 TESLA MAGNET.

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Materials research often demands novel experimental tools to make measurements under extreme conditions. At National High Magnetic Field Laboratory (NHMFL), we build a proof-of-concept X-ray diffractometer for the 25 Tesla (T) Florida Split Coil Magnet, for diffraction experiments under extremely high static magnetic fields. The influence of the large fringe magnetic fields requires that the X-ray source is located in an area, where the field is below 40G so that a Helmholtz compensation system can be used. The source (copper or molybdenum tube) is connected to the magnet by an evacuated beam tunnel to reduce the radiation absorption in air as shown in Fig. 1. Detectors are either an image plate or a single channel silicon drift detector controlled with a LabVIEW® based data acquisition system. First measurements on standard samples (e.g. Si and LaB_6 powder) are used to calibrate the diffraction system. Subsequently, we studied phase transitions in magnetic samples (stainless steel 301). The addition of X-ray diffraction to the 25T magnet expands the NHMFL experimental capabilities and will provide external users with the ability to probe spin-lattice interactions at static magnetic fields up to 25T.

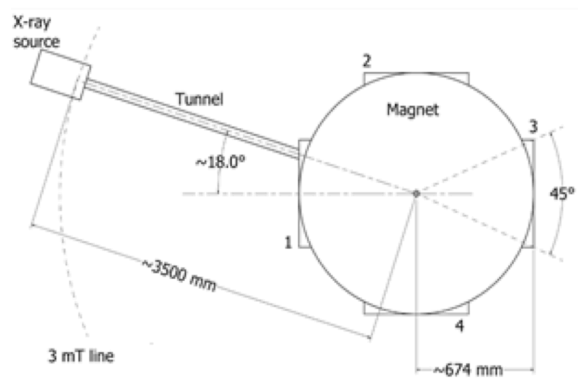

Fig. 1. Top view of the experimental setup, 1, 2, 3 and 4 are access windows. The image plate is mounted on the window 3.

Using this X-ray diffractometer, field-induced magnetic phases can be structurally investigated and correlated with other physical properties, such as electronic conductivity and optical properties. For example, the diluted magnetic semiconductors (DMS), which are obtained by doping magnetic impurities such as V, Cr, Mn, Fe, Co, and Ni into host semiconductors, are promising candidate materials for such structural investigation.

The authors acknowledge the support by National Science Foundation (NSF) DMR Award No.1257649. NHMFL is supported by NSF Cooperative Agreement No. DMR-1157490, the State of Florida, and the U.S. Department of Energy.

Category: FA
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