WSC6: Neutron diffraction and neutron spectroscopies: Instruments at the Budapest Neutron Center (short course)

Date: August 28 (post-conference)

Venue:. Institute of Isotopes, Hungarian Academy of Sciences, Budapest (Hungary)

Scientific sponsors: Institute of Isotopes, Hungarian Academy of Sciences

Contact person: Katalin Gméling (Institute of Isotopes, Budapest, gmeling@iki.kfki.hu)

Convenors: Révay Zsolt, László Rosta, Katalin Gméling (Institute of Isotopes, Budapest)

Invited speakers: to be announced later

Length (days): 1

Brief summary: Neutrons play an important role in science and technology. A series of techniques is available in the different neutron laboratories of the world: from the largest research reactors and spallation facilities to transportable neutron generators etc. for the investigation of the material structure and the chemical composition. The neutron source of the Budapest Neutron Center is a 10-MW water-cooled water-moderated research reactor, with the thermal flux of more than 10^{14} $cm^{-2}s^{-1}$ in its core. The reactor has a series of vertical channels for the purpose of short- or long-term irradiations, some of them equipped with a pneumatic transfer system to be used for neutron activation analysis. The ten horizontal channels serve different beam instruments. A cold neutron source is also operating in one of the tangential channels to serve three neutron guides. These cold neutron beams provide pure low-energy neutrons, ideal for chemical analysis and material science. They are summarized below.

PSD (Powder diffractometer with a position sensitive detector). This instrument is located in the reactor hall on a thermal neutron beam port. It can be used for powder diffractometry in general, for structural analysis of rocks and minerals, and identification of phases. The momentum transfer range is 1–12 $Å^{-1}$.

MTEST (Material Test), a monocrystal diffractometer. It is also located in the reactor hall on a thermal beam. It can be used for the investigation of tension in crystalline material.

TOF. A newly developed, unique, high-resolution time-of-flight diffractometer. Its parameters: $\Delta d/d = 10^{-3}$, momentum transfer range 1–6 $Å^{-1}$.

SANS, small angle neutron scattering instrument. It is located on one of the cold neutron beams and it is used for the investigation of inhomogeneous and anisotropic structures of nanostructures. The momentum transfer range: 10^{-3}–1 $Å^{-1}$.

ATHOS and *TAST*. Triple Angle Spectrometers, one located on a thermal beam in the reactor hall, the other in one of the cold neutron beams. It can be used for neutron spectroscopic studies of materials, e.g. cage effects, like hydrogen mobility in zeolites, and other nano porous crystalline materials, or for the determination of diffusion constant in solid samples. The method is based on the determination of the energy modification of monochromatic neutrons in inelastic scattering. The energy range available with the two instruments: 1–100 meV.

Dynamic Neutron Radiography. Located in the reactor hall on one of the thermal beams. It is used for the investigation of macroscopic inhomogeneities of bulk samples.

INAA. Instrumental neutron activation analysis. A highly sensitive nuclear analytical technique for the determination of trace elements. The well-equipped laboratories enable a sophisticated sample handling, and the short-transfer-time rabbit system allows the accurate determination of most elements above Na.

PGAA. Prompt gamma activation analysis. It is located at the end of one of the cold beams. One of the best cold-beam PGAA facilities in the world. PGAA is capable of analyzing the major and minor components of materials, especially useful for the analysis of light elements, even for trace amounts of H and B. The method is non-destructive and does not need any sample preparation.

No. of sessions: 2 (morning and afternoon; lectures and visit of the neutron guide hall)

No. of participants: max. 50

Level (suggested to): researchers

Price per participant: not confirmed yet

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