Collaborations

CEMHTI: Conditions Extrêmes et Matériaux : Haute Température et Irradiation, Orléans

PhyMat: Laboratoire de Physique des Matériaux, Poitiers

LPMTM: Laboratoire des Propriétés Mécaniques et Thermodynamiques des Matériaux, Villetaneuse

PMC/Polytechnique: Laboratoire de Physique de la Matière Condensée, Palaiseau

IM2NP: Institut Matériaux Microélectronique Nanosciences de Provence, Marseille

SIS2M-LAPA: Service Interdisciplinaire sur les Systèmes Moléculaires et les Matériaux - Laboratoire Archéomatériaux et Prévision de l'Altération, Saclay


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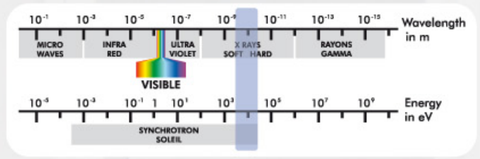
Energy range of DIFFABS: 3000-23000 eV



Light source: bending magnet

Experimental techniques:

- X-ray diffraction, large angle X-ray scattering
- X-ray absorption (EXAFS, XANES)
- X-ray fluorescence
- Combining these techniques to obtain additional information

Coupling diffraction and absorption measurements ensures that experiments are carried out on the same region of the sample in totally identical conditions (temperature, pressure, ambient atmosphere).

DIFFABS

Combining X-ray diffraction and absorption to study a large variety of materials

Topics and application

DIFFABS enables fundamental and targeted research projects to be carried out in areas (oil, nuclear, metallurgy) in which materials science and chemistry play an important role.

High temperature (100°c to 3000°C)

- Structural studies of melted oxides, metals and alloys
- Studies of fusion and phase transition mechanisms
- Synthesis of dense and nanostructured materials.

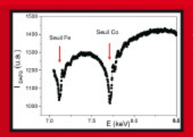
Facilities for induction heating of samples, coupled to aero dynamic levitation
Enables measurements (e.g. scattering) to be made on metal or alloy balls with a diameter of a few mm.

Liquid alumina ball.

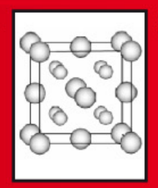
Applications in material sciences (glass, cements, ceramics) and in the nuclear sector (waste treatment).

Thin films and interfaces

- Mechanical properties of thin films and surface coatings.
- Atomic scale electrochemical interface structure.
- Nanomaterials



Thin film (10 nm) of $Co_xFe_{1-x}Si$ / Si(111). Variation of the (11-1) peak. CaF_2 phase at the K edge of Fe and Co. (See right figure).



CaF_2-type phase.

Applications in microelectronics, nanoelectronics, automobile industry and biomedical research.

Microbeams

- Pollutant characterization
- Studies of fragile and/or precious objects (non-destructive analysis)
- Characterization of iron corrosion system

Application in environmental science and Heritage materials.

Zoom: 6-circle diffractometer

The structural properties of a wide variety of materials can be studied using X-ray diffraction measurements, diffraction only or diffraction combined with X-ray absorption (XAS) or fluorescence (XRF) spectroscopy.

All these measurements are performed using a 6-circle diffractometer specifically built for DIFFABS. It is 3 metres high and 3.5 metres wide and weighs nearly 4.5 tons.

The diffractometer

- Directs the X-ray beam on the samples, most often of a few millimeters, inside specific set-ups (furnace, vacuum chamber,...) whose weight may reach 35 kg, and detectors whose weight may be more than 60 kg.
- Orients these samples in 3 dimensions.
- Detects the « response » of the samples to X-rays.