CENTRE OF EXCELLENCE OF MULTIFUNCTIONAL ARCHITECTURED MATERIALS
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CEMAM
Laboratoire d'excellence

CORE COMPETENCE 3: CHARACTERIZATION

CEMAM will gather research teams from several laboratory partners. It will promote a "materials by design" approach, starting from "engineering challenges", and proposing a strategy to meet multi- functional requirements by associating multimaterials and architectures.

The development of research on architectured multifunctional materials requires an increasing use of characterization methods at various dimensional scales. The consortium gathers a large variety of characterization techniques based on the characterization platform CMTC and the specific characterization lab's equipment.

THE CMTC CHARACTERIZATION PLATFORM

The CMTC platform is a fully staffed unit for physic-chemical and microstructural characterization at various scales, serving the materials community with a range of state-of-the-art characterization equipments and support services available for both academic and industrial laboratories as well as for educational training of students. It offers 12 different types of top level equipment including a SEM-FIB, combination of a high resolution scanning electron microscope (SEM) and focused ion beam (FIB) microscope in one single machine, allowing the acquisition of high resolution 3D data by a slice-and-view procedure.

This platform has a long history of sharing facilities. With more than thirty years of experience in the field of material science characterization, the CMTC platform has acquired a strong reputation for scientific expertise and quality service. The CMTC platform provides access to high quality facilities under various conditions of use to more than 20 public laboratories and 100 companies.

THE SPECIFIC CHARACTERIZATION LAB'S EQUIPMENT

In addition, some teams of the LABEX have other equipments dedicated to characterization of both structures and properties - mechanical as well as functional properties - of materials. They also have more specific equipments such as in situ analysis by Differential Electrochemical Mass Spectrometry or a SAXS/WAXS system. These teams are also strongly involved in developing new characterization techniques adapted to specific conditions. For instance, a photoelectrochemical microscope has been developed to image specifically the oxide formed on model and industrial alloys (ferritic and austenitic alloys, Zircaloy alloys). Advanced developments in Raman spectroscopy and imaging have been achieved.

INNOVATION HIGHLIGHTS

A new method based on transmission electron microscopy (TEM) coupled with an automatic mapping of crystallographic orientation and phase identification has been developed (ACOM/ASTAR) and is now applied to a wide range of nanostructured materials (ref : Coupled microstructural observations and local texture measurements with an automated crystallographic orientation mapping tool attached to a TEM, Rauch E, Veron M, Mat.wiss. u. Werkstofftech. 2005, 36, 10). The potential use of microscopes is therefore greatly increased, with the added advantage of obtaining fast, automated results and a more global and statistical view of nano-structures.




Combining long term competence with short notice reactivity

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Researchers are also strongly involved in the Large Scale Facilities, like the European Synchrotron Radiation Facility (ESRF). They are not only involved in user-mode but also as local contacts and user-developers of technique such as 3D imaging, in- situ measurements or combining techniques on beamlines such as Raman spectroscopy. Academic systems as well as industrial material can be studied using the Large Scale facilities in collaboration with the LABEX teams.

PROJECTS AND INVESTMENTS

CEMAM supports three major investments on the CMTC characterization platform:

• A new TEM-STEM equipped with a field emission gun (FEG) to achieve nano-metric resolution. Around this equipment will be conducted specific developments such as coupling chemical mapping and ASTAR mapping for phase identification.

• A new high resolution analytical SEM equipped with a field emission gun and EDS & EBSD systems, coupling X-ray chemical mapping and simultaneous EBSD orientation mapping. Original developments of in-situ nanoindentation in the SEM will be conducted for both mechanical and electrical measurements.

• A new high resolution X-ray tomograph (Sub-micron resolution) allowing non-destructive 3D imaging with versatile emission and detection devices for optimal performances at several energies. The integration in a large hutch and the high efficiency of the detector are suitable for the development of in situ tests.

HOW TO COLLABORATE

CEMAM offers a range of comprehensive solutions to serve the characterization needs of its partners and clients, by:

- Providing characterization services required for research program carried out by CEMAM and its partners,
- Developing know-how, competencies and new characterization techniques,
- Providing training in characterization techniques,
- Offering access to characterization resources after training,
- Providing characterization services via the CMTC platform to other organisations, including companies.

CONTACTS

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