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## CRISMAT - Laboratoire de cristallographie et sciences des matériaux

Rapport Hcéres

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# HCERES

High Council for the Evaluation of Research  
and Higher Education

Research units

HCERES report on interdisciplinary  
research unit:

Laboratoire de Cristallographie et Science des  
Matériaux  
CRISMAT

Under the supervision of the following  
institutions and research bodies:

École Nationale Supérieure d'Ingénieurs de Caen –  
ENSICAEN

Université de Caen Basse-Normandie – UCBN

Centre National de la Recherche Scientifique – CNRS

Evaluation Campaign 2015-2016 (Group B)

# HCERES

High Council for the Evaluation of Research  
and Higher Education

Research units

*In the name of HCERES,<sup>1</sup>*

Michel Cosnard, president

*In the name of the experts committee,<sup>2</sup>*

Joao Rocha, chairman of the committee

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Under the decree No.2014-1365 dated 14 november 2014,

<sup>1</sup> The president of HCERES "countersigns the evaluation reports set up by the experts committees and signed by their chairman." (Article 8, paragraph 5)

<sup>2</sup> The evaluation reports "are signed by the chairman of the expert committee". (Article 11, paragraph 2)

## Evaluation report

This report is the sole result of evaluation by the expert committee, the composition of which is specified below.

The assessments contained herein are the expression of an independent and collegial reviewing by the committee.

**Unit name:** Laboratoire de Cristallographie et Science des Matériaux

**Unit acronym:** CRISMAT

**Label requested:** UMR

**Current number:** 6508

**Name of Director  
(2015-2016):** Mr Antoine MAIGNAN

**Name of Project Leader  
(2017-2021):** Mr Wilfrid PRELLIER

## Expert committee members

**Chair:** Mr Joao ROCHA, University of Aveiro, Portugal

**Experts:**

- Mr Éric BEAUREPAIRE, Université de Strasbourg
- Mr Olivier FRUCHART, Université de Grenoble
- Mr Christian MASQUELIER, Université de Picardie (representative of the CNU)
- Mr Matthew ROSSEINSKY, Royal Society, University of Liverpool, UK
- Mr Philippe THOMAS, SPCTS, Université de Limoges (representative of the CNRS)
- Ms Corinne ULHAQ, Université de Strasbourg

**Scientific delegate representing the HCERES:**

Mr Marc DRILLON

**Representatives of supervising institutions and bodies:**

Mr Marco DATURI, ENSICAEN

Mr Daniel DELAHAYE, Université de Caen

Mr Niels KELLER, CNRS INP

Ms Aurélie MENARD, CNRS DR19

Mr Jean-François TASSIN, CNRS INC

**Head of Doctoral School:**

Mr Frédéric JURIE, Doctoral school n°181 "SIMEM"

## 1 • Introduction

### History and geographical location of the unit

CRISMAT was created in 1986 as a unité mixte de recherche, headed by Mr Bernard RAVEAU until 2003 and since then by Mr Antoine MAIGNAN. In January 2015, Mr Wilfrid PRELLIER became deputy director and will become the director in the new contract. CRISMAT is affiliated to ENSICAEN and Université de Caen Basse-Normandie and associated to the CNRS, primarily to the Institut National de Chimie (INC), and secondarily to the Institut National de Physique (INP). CRISMAT is housed in two ENSICAEN buildings covering a total area of 6000 m<sup>2</sup> (one of the buildings is shared with two other labs, LCMT and LCS). Personnel in the joint research lab LaMIPS are housed at the Caen NXP and PRESTO sites at, respectively, Colombelles and Giraf. CRISMAT hosts first-class equipment facilities, particularly for transmission electron microscopy and X-ray diffraction.

### Management team

Direction: Dr. Antoine MAIGNAN

Directeur-Adjoint: Dr. Wilfrid PRELLIER

### HCERES nomenclature

Principal - ST4, Secondary - ST2; keywords - ceramics, structural materials, materials for electronics

### Scientific domains

Physics and Chemistry of Materials

Condensed Matter Physics

New Energy Technologies

Electron Microscopy

Crystallography

## Unit workforce

Unit workforce	Number on 30/06/2015	Number on 01/01/2017
N1: Permanent professors and similar positions	31	30
N2: Permanent researchers from Institutions and similar positions	17	17
N3: Other permanent staff (technicians and administrative personnel)*	22	20
N4: Other professors (Emeritus Professor, on-contract Professor, etc.)	4	
N5: Other researchers from Institutions (Emeritus Research Director, Postdoctoral students, visitors, etc.)	5	
N6: Other contractual staff (technicians and administrative personnel)*	3	
N7: PhD students	36	
TOTAL N1 to N7	118	
Qualified research supervisors (HDR) or similar positions	34	

\* These staff members belong to common services of the laboratory.

Unit record	From 01/01/2010 to 30/06/2015
PhD theses defended	55
Postdoctoral scientists having spent at least 12 months in the unit	24
Number of Research Supervisor Qualifications (HDR) obtained during the period	3

## 2 • Overall assessment of the interdisciplinary unit

### Introduction

CRISMAT is an internationally-leading multidisciplinary unit in the fields of materials chemistry and physics, gathering considerable know-how in the synthesis and elaboration, physical characterisation and theory across a broad range of materials areas. Its main asset is the remarkable multidisciplinary integration of scientists with different expertise and interests to carry out fundamental or applied research. Studies encompass areas such as: novel multiferroics, thermoelectrics, materials for lithium and sodium batteries, magnetic materials, complex oxide and hybrid hetero-structures and layered oxides, ferrites, functional ceramics, composites and structural materials, materials (and systems) for electronics. The unit stands out for its talented Transmission Electron Microscopy (TEM) and X-Ray Diffraction (XRD) characterisation skills and advanced crystallography methods, and for its experience in establishing relationships between crystal structure and a plethora of properties including dielectricity, ferroelectricity, thermoelectricity, photoluminescence, magneto-transport, superconductivity, energy storage, electro/magneto/thermomechanics. The unit performs first-class work exploiting engineered interfaces and heterostructures. CRISMAT is also highly skilled in advanced elaboration techniques, such as pulsed laser ablation, spark plasma sintering and hydrothermal methods, and in ceramics shaping and texturing. Since 2011, the unit's international status and visibility have been raised, as witnessed, e.g., by the increasing numbers of papers published in high-impact journals (including in Science and Nature series), which are receiving more citations, or the organisation of prestigious events, such as the Gordon Research Conference in Solid State Chemistry.

### Global assessment of the unit

CRISMAT is a first-class unit, internationally leading in materials chemistry and physics, having a strong leadership, clear scientific objectives and the drive to achieve them. The unit gathers considerable know-how in the synthesis and elaboration, physical characterisation and theory across a broad range of materials areas. The scientific output of the lab is high, with many papers published in prominent journals and receiving a large number of citations. CRISMAT's international reputation is also witnessed from, among others, the number of invited conferences delivered and scientific events organised, participation in international projects and networks, membership of journal boards and learning societies. The highly skilled CRISMAT knowledge base has created opportunities for a strong and sustained involvement with local and national companies, in particular through LaMIPS. There is, nevertheless, further room for strengthening such collaboration and better securing the generated IP. Concerning high-level training and mentoring of Ph.D. students and post-docs, CRISMAT provides a strong contribution with an excellent scientific culture and equipment infrastructure, frequent exchanges with reputed international institutions and with companies, and regional, national and European networking. A renewed leadership and an ambitious scientific programme for the future ensure that CRISMAT's reputation will endure in the coming five-year period.

### Strengths and opportunities in the context

- reputation as internationally leading in materials science, with true multidisciplinary in chemistry and physics;
- strong leadership and clear scientific objectives;
- outstanding expertise in materials synthesis and elaboration, and in TEM and XRD;
- very good regional, national and European networking;
- high scientific output in journals of very good to excellent impact;
- strong and sustained involvement with local and national companies;
- excellent conditions for training and mentoring of Ph.D. students and post-docs.

### Weaknesses and threats in the context

- despite an excellent productivity, uneven contribution of teams and individual researchers;
- number of papers in very high impact factor (>6-7) journals still not at the level it could be;

- less than optimal participation in and leadership of European (and ANR) projects;
- few patents filed;
- small number of post-docs.

### Recommendations

The panel notes the excellent productivity of the unit but considers there is room for achieving a more even contribution of teams and individual researchers; the exciting research being carried out deserves even more visibility and, thus, the trend to publish in high impact factor journals should be sustained. There is opportunity for further strengthening the links between theory and experiment, and to develop the former.

There is opportunity to raise CRISMAT's international profile by capitalising on the excellent science performed and participating in and leading more H2020 projects, receiving more invitations to talks at high-profile conferences, attracting more post-docs (e.g., through European programmes, such as Marie Curie).

Increase the number of patents filed and profit from the inception of Normandy Valorisation; raise the awareness of all unit members, including students, for the opportunity to commercially exploit the knowledge created at CRISMAT, including software, databases, materials, techniques, processes, methods, etc.

More may be done to encourage the emergence of new leadership across the teams in the future; the panel strongly supports the idea of organising all-lab and group-seminars open to all unit members, including the technical staff; spread good team animation practices; intensify scientific exchange within and between teams, profiting even more from scientific complementarities and exploiting new opportunities; increase visibility of technical staffs in the unit's life.

Number of Ph.D. students and post-docs mentored may be further increased.