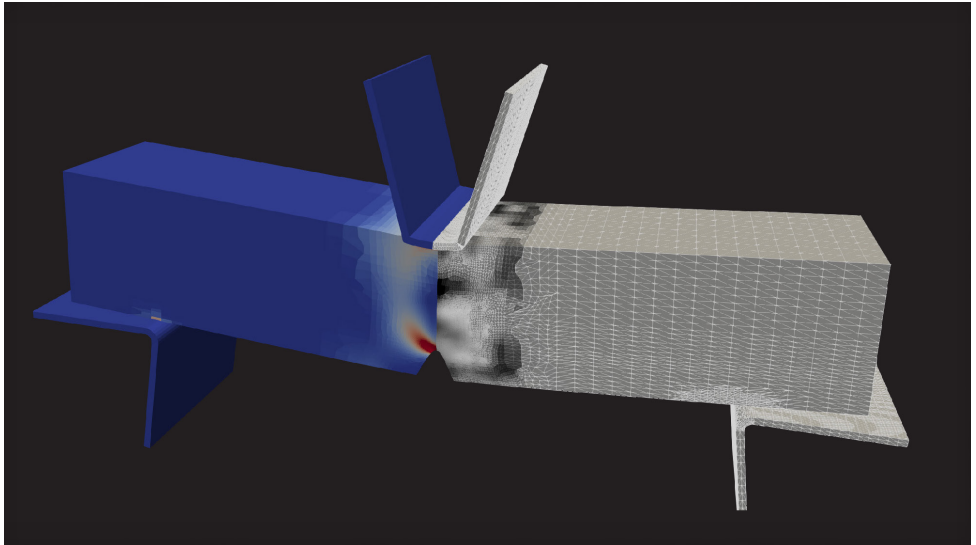


CMAT MATERIALS CENTER

CMAT: RESEARCH TO INNOVATE AND TRANSFORM THE ECONOMY

The Materials Center (CMAT), *Centre des Matériaux*, established in Évry in 1967, is the largest of the 18 research centres at Mines Paris – PSL. The centre is a joint research unit (UMR 7633) affiliated with the CNRS, within its Engineering

Department. It is also a member of the Île-de-France Federation for the Mechanics of Materials, Structures and Processes, and the Île-de-France Federation for Metallurgy.



*Numerical simulation of a Charpy test
with highly non-linear behaviour.*

CMAT specializes in structural materials for the aerospace, energy, space, automotive, and mechanical engineering sectors, as well as in advanced materials for electronics, energy storage, and biomedical applications.

The centre works closely with major industrial groups and SMEs to develop cutting-edge technological solutions.

In line with a double-impact research approach, CMAT forges strong connections between academic research and industry—helping to shape the strategies of economic stakeholders and fostering innovative collaborations to meet today's major challenges.

KEY FIGURES OF CMAT

41

faculty
researchers

70

PhD
students

43

engineers,
technical
support staff

Civil Engineering Program

- Core Modules
- Materials Science and Engineering Option
- Digital Engineering and Complex Systems Option

1

Specialized Masters

DMS “Materials
and Structures Design”

+500

engineers and
PhD graduates trained

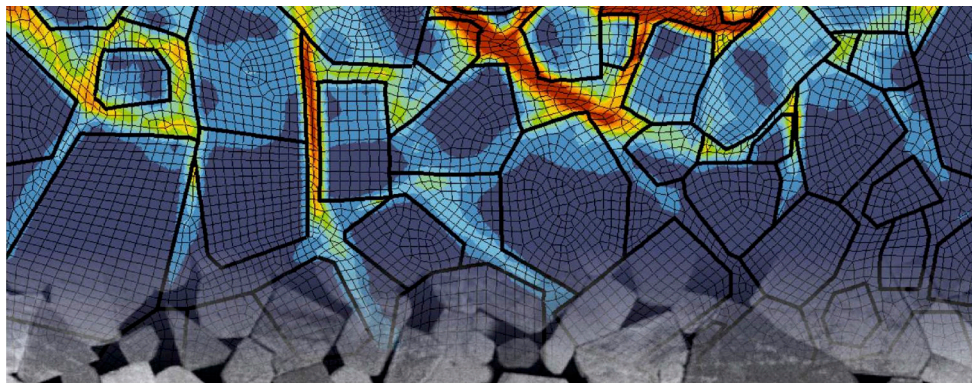
20 theses / year

defended at CMAT, out of the approximately 100 at Mines Paris – PSL

spread across two specialties of the ISMME 621 doctoral school:

- Systems Engineering, Materials, Mechanics, Energy
- Materials Engineering and Mechanics

STRATEGIC FOCUS AREAS OF CMAT: COLLABORATIVE RESEARCH BETWEEN PHYSICOCHEMISTS, MECHANICS EXPERTS, AND COMPUTATIONAL SCIENTISTS



Cumulative plastic deformation field in a ceramic-metal composite (tungsten carbide/cobalt) in impact simulation during deep drilling in hard rock.

Three research hubs

Materials and Structures Simulation (SIMS)

The SIMS hub aims to improve the modeling of material behavior and fracture in computational codes. This includes the development of digital software and collaborations with other teams to compare theoretical models with experimental results, both at national and international levels.



Experimental Mechanics — Materials (MEM)

The MEM hub focuses on the study of metallic materials, polymers, composites, ceramics, and refractories. It seeks to understand deformation, damage, and fracture mechanisms through microstructural observations and analysis of physical parameters at various scales.



Genesis and Evolution of Microstructures (GEM)

The GEM hub studies phase transformation, deformation, and damage phenomena in materials, as well as the effects of the environment (oxidation, temperature, irradiation). It combines disciplines such as metallurgy, crystallography, and surface science to control and optimize material microstructures.

Five support platforms

At the service of research hubs and industrial and academic partners.
Discover our areas of expertise.

AT-JPE: mechanical workshop

- Mechanical assemblies (mechanical testing machines, tribological image furnaces, etc.), machining of all types of test specimens
- Metal removal machining, spark erosion (electroerosion)
- Welding / Forming / Cutting

μMAX: microstructure, metallography, analysis, x-ray diffraction

- Optical Microscopy (OM)
- Scanning Electron Microscopy (SEM)
- Transmission Electron Microscopy (TEM)
- Metallography
- X-ray Diffraction (XRD)
- Physical Measurements

EPROM: elaboration, processes and materials

- L-PBF (Laser Powder Bed Fusion)
- MBJ (Metal Binder Jetting)
- Cold Spray
- 3D Printing
- Heat treatments
- Elaboration furnaces
- Powder Metrology

SESAMES: experimental support for materials and structures analysis

- Monotonic tests: Tension / Compression - Creep / Relaxation
- Cyclic tests: Fatigue - Fretting - Thermal Fatigue
- Thermal: Resistive Furnaces / Radiant Furnaces / Induction / Climate Chambers
- Strain Gauging: Contact / Non-contact
- Kinematic Field Measurements: Thermal / Acoustic
- Environment and Atmosphere: Air / Gases / Vacuum / Aqueous
- Crack monitoring: Optical / Electrical Methods / Acoustic Emission
- Calibration (F, ΔL , T)

SISDEV: support in scientific computing and development

- Support for conducting studies (from project setup to execution) on scientific digital tools and electronic control and acquisition systems
- Consolidation, long-term maintenance, and enhancement of developments within dedicated digital tools
- Providing users with an ever-improving user experience
- Supporting and training in the use of digital tools (internal tools, external tools, programming in C++/Python/...)

FUTURE PROJECTS

Mines Paris – PSL is in close synergy with the corporate world:

**Around 1,000 new
research contracts
per year**

**200 industrial
partners**

**81 patents,
including 24 at
CMAT**

EPROM 2025: a center of excellence for additive manufacturing and materials health

The project, led by CMAT and supported by Carnot M.I.N.E.S, structures a cutting-edge technological platform for additive manufacturing. Its goal: to combine innovation, research, and training to address industrial challenges in the aerospace, space, and defense sectors.

In addition to its existing capabilities, the platform will feature a unique experimental setup for Wire Laser Additive Manufacturing (WLAM), enabling the production of large-scale parts while integrating an advanced materials health approach. This dual expertise will ensure precise control over material properties and optimize their durability.

Scheduled to be accessible to businesses by fall 2025, EPROM 2025 is a center of excellence supported by the Île-de-France region, dedicated to enhancing the skills of both industrial and academic stakeholders.

The Materials Center of Mines Paris – PSL follows a high-level research development policy in collaboration with industrial partners in the fields of aerospace, automotive, energy, nuclear, steelmaking, equipment manufacturing, and space.

The CMAT organizes its activities into three main areas:

**Development of
materials and processes**

**Experimental characterization
and modeling of material behavior**

**Development of numerical models
and structural calculations**

SUPPORT FOR INNOVATIVE PROJECTS

Mines Paris – PSL mobilizes the expertise of its research teams and specialists to establish collaborations:

- Exploring new markets
- Access to funding and grants for collaborative projects
- Strengthening teams through the integration of specialized skills (industrial PhD contracts, etc.)
- Expanding professional networks and increasing visibility
- Activities with high societal impact

DID YOU KNOW?

CMAT has trained over 500 PhDs since its creation in 1967.



Jean-Jacques Favier
Astronaut
1977: PhD
Columbia STS-78 mission



André Pineau
2000: National Academy of
Technologies of France



Samuel Forest
2022: Member of the French
Academy of Sciences, "Mechanical
and Computational Sciences" section

Contact : mat@minesparis.psl.eu
Website : www.mat.minesparis.psl.eu



60, boulevard Saint-Michel
75272 Paris Cedex 06

For more information:

communication@minesparis.psl.eu
www.minesparis.psl.eu

