BUILDING TOGETHER
THE UNIVERSITY OF TOMORROW
UMI ELyTMaX

Engineering Science Lyon-Tohoku: Materials under eXtreme conditions

Our PhD training policy

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Two sites for the laboratory:
@Tohoku University, Sendai, Japan
@ Université de Lyon, Lyon, France
A LEADING ACADEMIC AND RESEARCH CONSORTIUM
OF 12 FOUNDING MEMBERS
THE UNIVERSITÉ DE LYON – KEY FIGURES

140,000 STUDENTS
(INCLUDING 20,000 INTERNATIONAL STUDENTS)

6,800 PhD RESEARCHERS AND PhD PROFESSORS

13 CAMPUSES IN LYON AND SAINT-ÉTIENNE

171 INTERNATIONAL TRAINING PROGRAMS AND JOINT DEGREES

168 PUBLIC RESEARCH LABORATORIES

12 LABORATORIES OF EXCELLENCE (LABEX)

Around 1000 PhD
150 Double PhD ("Cotutelles")
thesis defended /year
WHAT IS IDEXLYON?

• A Call for Proposals called “Investments for the future (IDEX)” launched by the French Government and the National Research Agency (ANR) in 2012;

• Its objective: to create some ten world-class clusters of excellence in higher education and scientific research in France;

• The Université de Lyon was awarded the IDEX Label in 2017 by an international jury. This label is called IDEX LYON

• The Université de Lyon receives around 25 million € per year thanks to this label.
IDEXLYON – KEY FIGURES

A CONSORTIUM OF 12 INSTITUTIONS

€25 MILLION PER YEAR AND €800 MILLION ENDOWMENT

8 ACADEMIC COLLEGES

MORE THAN 50 ACTIONS IMPLEMENTED, DISTRIBUTED IN 5 PROGRAMME COMPONENTS

3 MAJOR ACADEMIC AXIS:
- BIO HEALTH AND SOCIETY
- SCIENCE AND ENGINEERING
- HUMANITIES AND URBANITY

A PROGRESS REPORT WITHIN 2 YEARS, AND A 4-YEAR PROBATIONARY PERIOD
INTERNATIONAL POLITICS OF UNIVERSITE DE LYON

EUROPE

- European Call for proposals
- Privileged relations with the border regions: Northern Italy and French-speaking Switzerland
  - Cross-border doctoral workshop from 19 to 21 November 2018 at the University of Turin: "After the PhD? Prepare your future!"
- Alliance Rhodanian Campus
  - University of Geneva, University of Grenoble-Alpes, University of Applied Sciences of Western Switzerland, University of Lausanne and Université de Lyon
  - Call 2018, (€ 200,000) to consolidate scientific synergies
  - Objective: development of scientific cooperation and mobility ("cotutelles", joint research projects, infrastructure sharing, etc.)
THE UNIVERSITY OF LYON
INTERNATIONAL ALLIANCE: 4 MAIN TARGETS

University of Ottawa
University of Sherbrooke
Polytechnique Montreal
Montreal university

University of São Paulo

University of Tokyo
Tohoku University

East China Normal University
University of Fudan
Chinese Academy of Sciences
Tongji University
Shanghai Jiao Tong University

3 International Joint Units with CNRS
THE INTERNATIONAL ALLIANCE AT THE SERVICE OF COOPERATION

- Impulses Collaborative Science Platforms
- Supports the organization of workshops, summer schools, joint training courses
- Provides funding to initiate joint science programs
- Develops mobility programs
  - CSC (China): 30 incoming doctoral fellowships
  - In-house physician exchanges with the University of Ottawa,
  - Annual Summer Schools between UdL and Ottawa, Shanghai Jiao Tong, Tohoku Universities
  - In & Out Mobility financial support for Master and PhD students (6 months)
  - ....
An example of International Joint Unit: ELyTMaX
A long history of collaboration initiated more than 30 years ago… in the field of Smart Materials and Tribology
- Prof Georges, Prof Kato, Prof Gobin, Prof Tani
- Organization of various bilateral workshops
- Series of joint projects (IRCP – JSPS&CNRS, etc.)
- Extension of collaboration fields…
- 2004: opening of Liaison Offices, at INSA and at TU
- 2005: double Master degrees between ECL and TU and between INSA and TU
- 2007: 50th anniversary of INSA-Lyon
  100th anniversary of Tohoku University
  150th anniversary of EC-Lyon
- 2009: first double PhD degrees between ECL and TU and between INSA and TU started…
ELyT: A PLATFORM FOR COLLABORATION BY UNIVERSITE DE LYON, TOHOKU UNIVERSITY AND CNRS

2004
Liaisons offices opened

2005
Double Master degrees between ECL and TU and between INSA and TU

2008
Creation of LIA ELyT Lab

2009
First ELyT School

2012
Double-PhD degree agreements TU /INSA Lyon and TU /ECL

2016
Creation of ELyTMaX Located in Tohoku University

2017
Creation of LIA ELyT Global

2018
Launch of ELyTMaX@Lyon, located in Univ. Lyon (INSA Lyon and ECL)
KEY POINTS ON ELyTMaX

ELyTMaX is an operational research unit

• Specific staff (as for Oct. 2018):
  ▪ 13 permanent staff (3 from France & 10 from Japan), ~6 eq. full time researchers, 3~4 researcher working full time “abroad”
  ▪ 3 postdocs, 5 DD PhD students, 1 master student
  ▪ 3 part-time administrative staff
  ▪ >15 full time people

• Specific research premises:
  ▪ 170m² at MaSC, Tohoku Univ.
  ▪ 150m² lab. space, INSA, Lyon + EC-Lyon

• Funded projects:
  ▪ France: ANR ECPOR
  ▪ Japan: 1 JSPS Kiban A, 1 JSPS Kiban B
  ▪ Bilateral: ANR-MEXT PYRAMID
  ▪ 2 industrial contracts

• Publications from 2016:
  ▪ 16 peer reviewed journal papers,
  ▪ 6 invited conferences,
  ▪ 50+ international conferences

• ELyTMaX is also a professor exchange platform

Japan site inauguration, Sendai, Oct 4th, 2016
Inauguration of French site, March 5th, 2018 & Lyon Center (IFS), Nov. 21th, 2018, Lyon
*In blue: people who worked or are working “abroad” at ELyTMaX, i.e. in another country than that of their employer; for a time >6 months*
ELyT: Engineering Science Lyon-Tohoku
Integrated cooperation

- Laboratoire International Associé (LIA):
  - Large researcher network, bridging Engineering Science between Lyon and Tohoku, with ~25 ongoing projects
  - Annual workshop (80~100 attendees)
  - 100+ joint peer-reviewed papers
  - 200+ joint conferences
- DD programs agreements at Master and PhD levels: more than 20 double degree PhD from 2008, 10 ongoing

Summer school ELyT School
- Since 2009, held alternatively between France and Japan institutions (INSA-Lyon, Ecole Centrale de Lyon, and Tohoku University).
- Thematic: "Energy, Environment, Safety and Engineering"
- ~50 graduate school students, including ~25 from abroad.
OUTLOOKS... ELyT AS A “PLATFORM” ....

We have developed an integrated system

- Liaison Office: to welcome visitors from each side
- Network of researchers: to foster cooperation
- Physical lab: to conduct jointly cutting-edge research
- Summer School: to attract students
- Double master degrees
- Double PhD degrees
- Post-doc positions
- Permanent staff long term mobility

....FOR ENHANCING SCIENTIFIC COLLABORATION
THANK YOU FOR YOUR ATTENTION

With the support of:
Extending lifetime of materials and structures

One key example of material under extreme conditions: materials used in thermal power plants, subjected to erosion and corrosion.

Photographs: installation of electromagnetic Non-Destructive systems for monitoring the wall thickness of cooling circulation pipes, in Fukushima Dai-Ichi power plant (credit: Toshiyuki Takagi)
ELyTMaX scientific topics

- **Materials for industrial applications**
  - Protecting materials by additive manufacturing techniques (e.g. Cold-spray)
  - Understanding degradation mechanisms (corrosion, tribo-corrosion, fatigue-corrosion)
  - Follow-up of the degradation and/or other changes in structural materials (Non Destructive Testing)
  - Multi-objective optimization of systems

- **Materials for energy conversion**
  - Modelling and testing of materials and systems under high solicitation levels (e.g. energy harvesting devices)
  - Materials modelling for Non Destructive Testing
  - Research on multiphysics couplings for new sensing / actuation capabilities
Extending lifetime of materials and structures

- Electrochemical processes
- Complex solicitations / environments
- Multiphysics couplings

- Molecular dynamics
- Plasticity and hysteresis semi-physical models
- 3D extensions
- Multiphysics models

- Degradation of cold sprayed materials
- Model of materials during cold-spray

- Nondestructive techniques
- Cold-spray technique
- Multi-objective optimization

Every project developed within ELyTMaX involves strong complementarities from Japanese and French sides.