



BUILDING TOGETHER THE UNIVERSITY OF TOMORROW



UNIVERSITÉ
DE LYON

UMI ELyTMaX

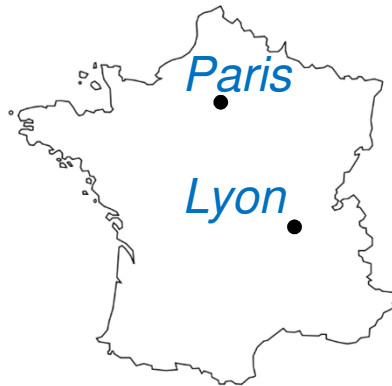
Engineering Science **Lyon-Tohoku**: **M**aterials under e**X**treme conditions

Our PhD training policy

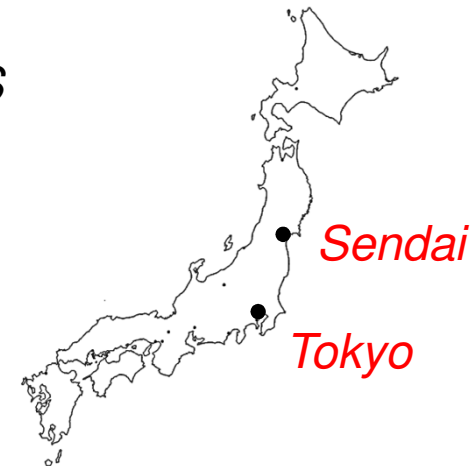
Jean-Yves Cavaille, Gael Sebald and, Kazuhiro Ogawa

ELyTMaX, IFS Lyon Center

UdL, Tohoku University & CNRS



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)



13 CAMPUSES IN LYON
AND SAINT-ÉTIENNE



6,800 PhD RESEARCHERS
AND PhD PROFESSORS



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



MORE THAN 50 ACTIONS IMPLEMENTED, DISTRIBUTED IN 5 PROGRAMME COMPONENTS



€25 MILLION PER YEAR AND €800 MILLION ENDOWMENT



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



8 ACADEMIC COLLEGES



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

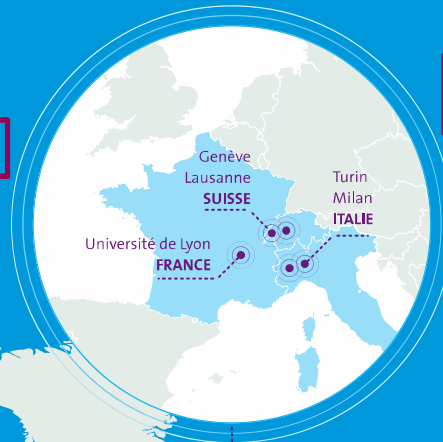
University of Ottawa

University of Sherbrooke

Polytechnique Montreal

Montreal university

3 International Joint Units with CNRS



University of Tokyo
Tohoku University

Université d'Ottawa
Montréal
Sherbrooke
CANADA

Université de Tokyo
Université Tohoku, Sendai
JAPON

ECNU
Université de Tongji
SHANGHAI • CHINE

University of São Paulo

Universidade de São Paulo
BRÉSIL

East China Normal University
University of Fudan

Chinese Academy of Sciences

Tongji University

Shanghai Jiao Tong University

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)
 -

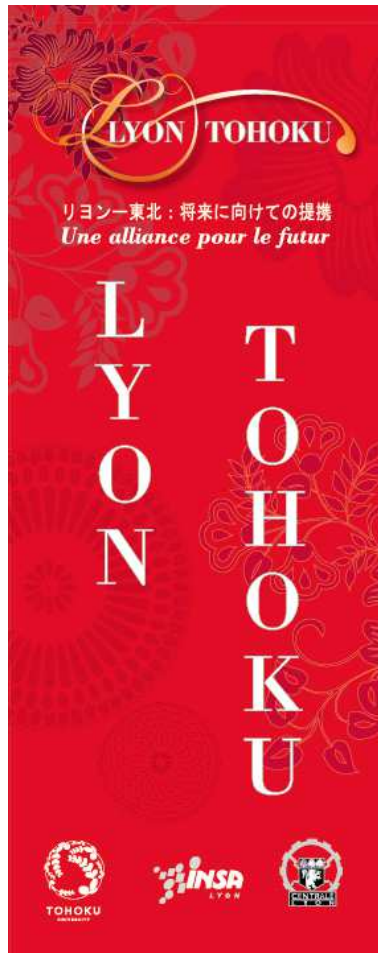
An example of International Joint Unit: ELyTMaX



UNIVERSITÉ
DE LYON

Engineering science **Lyon-Tohoku** project

Genesis of “**ELyT**”

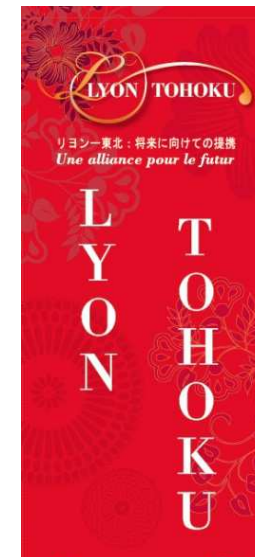
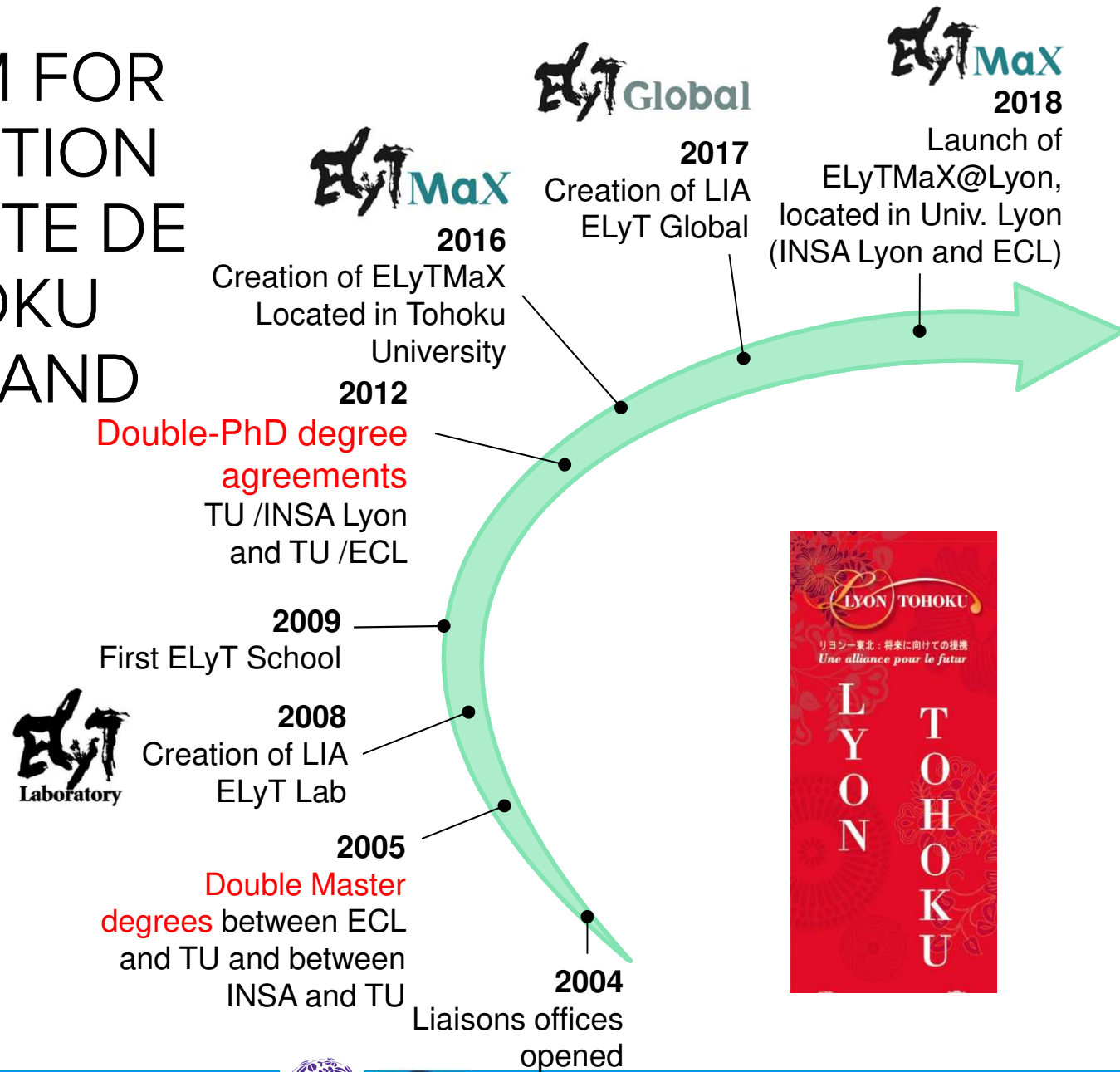


- A long history of collaboration initiated more than 30 years ago... in the field of Smart Materials and Tribology
 - Prof Georges, Prof Kato, Prof Gobin, Prof Tani
- Organization of various bilateral workshops
- Series of joint projects (IRCP – **JSPS&CNRS**, etc.)
- Extension of collaboration fields...
- 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...



*December 2008:
Launch ELyT lab*

ELyT: A PLATFORM FOR COLLABORATION BY UNIVERSITE DE LYON, TOHOKU UNIVERSITY AND CNRS



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*

ELyTMaX MEMBERS

Jean-Yves
CAVILLE
(INSA-Lyon,
CNRS)



Tetsuya
UCHIMOTO
(IFS, TU)



Chrystelle
BERNARD
(FRIS, TU)



Bhaawan
GUPTA
PhD DD



Gael
SEBALD
(INSA-Lyon,
CNRS)



Masami
NAKANO
(IFS, TU)



Hiroshi
OIKAWA
(OAS, TU)



Elisaveta
LAPUSHKINA
PhD DD



Nicolas
MARY
(INSA-Lyon,
CNRS)



Hiroki
KUWANO
(NICHe, TU)



Sayaka
UNOURA
(OAS, TU)



Kathleen
JAFFRE
PhD DD



Kazuhiro
OGAWA
(GSE, TU)



Makoto
OHTA
(IFS, TU)



Kanako
TANNO
(OAS, TU)



Pradeep
MOHANASUNDARAM
PhD DD



Toshiyuki
TAKAGI
(IFS, TU)



Atsuki
KOMIYA
(IFS, TU)



Gildas
DIGUET
(CNRS)



Lucas
OLLIVIER-LAMARQUE
(Master DD INSA-Lyon / GSE)



Yutaka
WATANABE
(GSE, TU)



Koji
SHIMOYAMA
(IFS, TU)



Kesavan
RAVI
(JSPS
posdoc)



**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

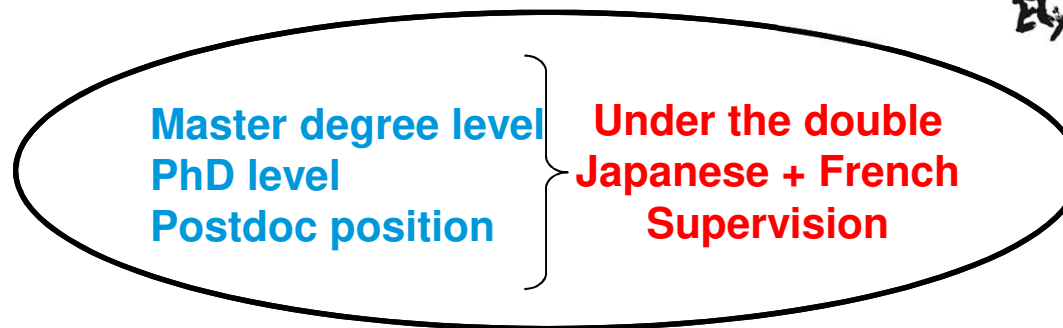
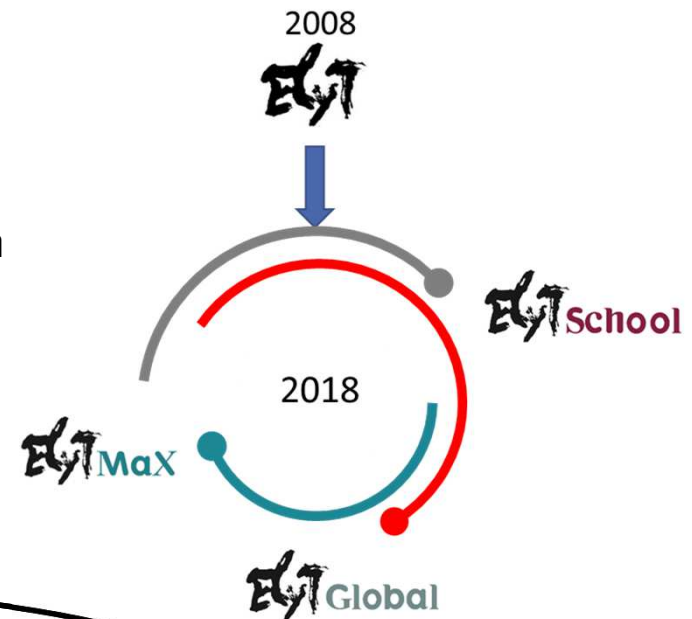
- Since 2009, held alternatively between France and Japan institutions (INSA-Lyon, Ecole Centrale de Lyon, and Tohoku University).
- Thematic: "Energy, Environment, Safety and Engineering"
- ~50 graduate school students, including ~25 from abroad.



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:



GRAND LYON
la métropole



La Région
Auvergne-Rhône-Alpes



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)

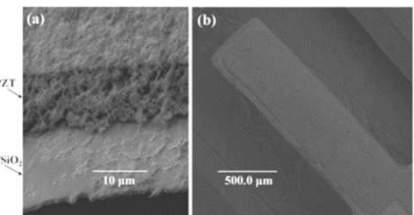
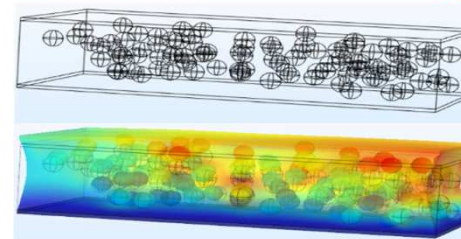
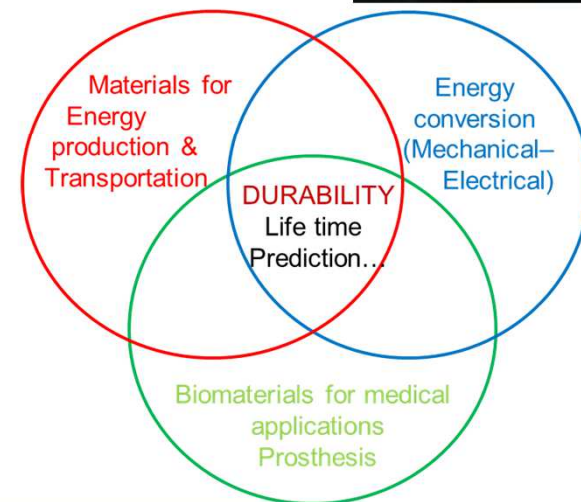
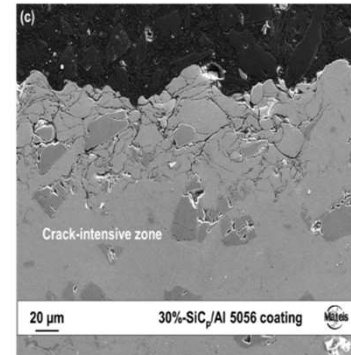
ELyTMaX scientific topics

➤ 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

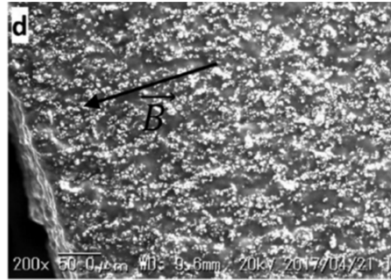
➤ Materials for energy conversion

- 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



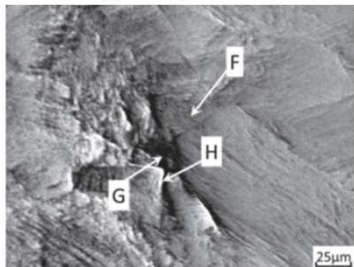
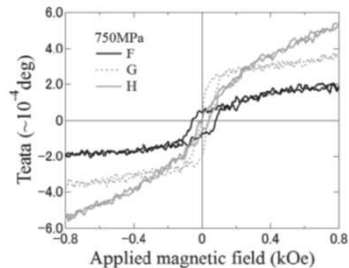
Extending lifetime of materials and structures

Sebald, *Sci. Tech. Adv. Mater*, 2017,
doi: 10.1080/14686996.2017.1377590



Heterogenous materials for improved electromechanical couplings

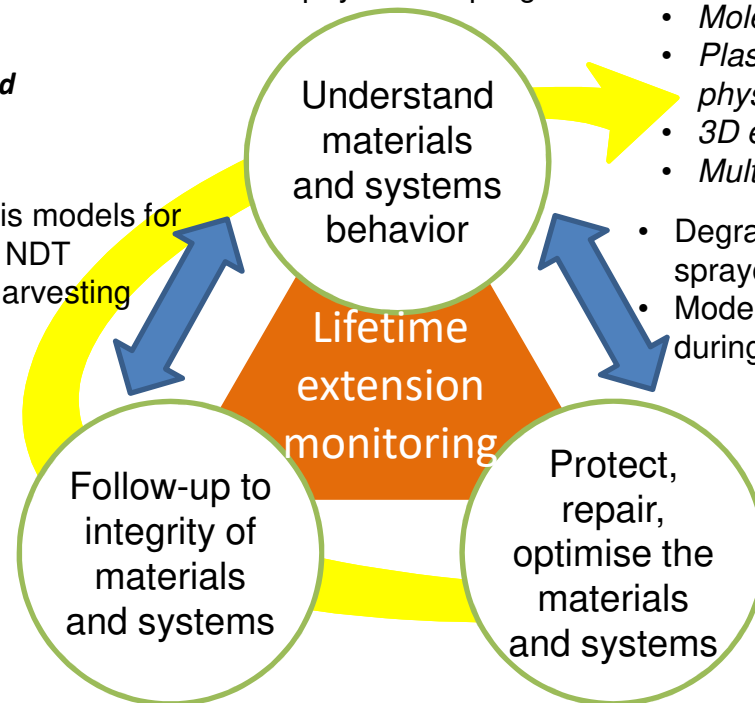
Terashima, *Int. J. Appl. Electromag*, 2016, doi:
10.3233/JAE-162055



Quantification of residual stresses in ferromagnetic steels

- Electrochemical processes
- Complex solicitations / environments
- Multiphysics couplings

- Hysteresis models for accurate NDT
- Energy harvesting

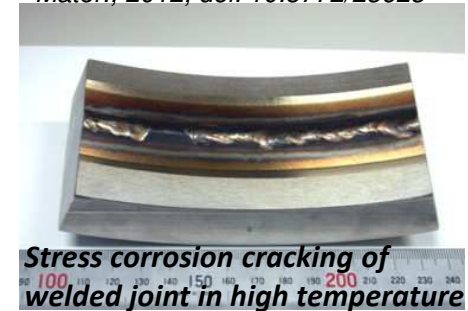


- Nondestructive techniques

- Cold-spray technique
- Multi-objective optimization

➤ **Every project developed within ELyTMax** involves strong complementarities from Japanese and French sides

Abe & Watanabe, *J. Nuclear Mater.*, 2012, doi: 10.5772/23623



Stress corrosion cracking of welded joint in high temperature

Ogawa, *IntechOpen*, 2011, doi: 10.5772/23623



Repair of materials using Cold Spray technique

