

**Collaborative Research Projects – 2021**  
**Laboratory for Materials and Structures,**  
**Institute of Innovative Research, Tokyo Institute of Technology**

## **Outline and Application Instructions**

### **1. Outline of the Projects**

The Collaborative Research Projects (hereafter, “CRP”) of the Laboratory for Materials and Structures (hereafter, “MSL”), Institute of Innovative Research, Tokyo Institute of Technology, include the following five different types of research and workshop to be carried out at MSL/ organized by MSL in collaboration with MSL faculties including Assistant, Associate, and Full Professors (hereafter, “MSL Faculties”).

#### **International CRP (of Category A, B or C):**

Research project conducted by a team consisting of MSL faculties and researchers of foreign organizations using the facilities, equipment, data, etc., available at MSL.

#### **General CRP (of Category A, B or C):**

Research project conducted by a team consisting of MSL faculties and researchers of other organizations, using the facilities, equipment, data, etc., available at MSL.

#### **Topic-Specified CRP:**

Research projects on one of the following topics coordinated by MSL faculties and conducted by a team consisting of MSL faculties and researchers of other organization, using the facilities, equipment, data, etc., available at MSL.

Specified Research Topics (Please see the abstracts of the topics on page 4.)

1. Establishment of thermal expansion tuning method by using giant negative thermal expansion materials
2. Elucidation and design of material functionalities based on computational and data science
3. Development of Performance Evaluating Method of Building Structures for Controlling Damage
4. Development of life innovation materials with assist of inverse design
5. Development of New Functionalities in Abundant Element Materials

#### **International Workshop:**

Small-scale international discussion meeting on a focused topic to promote MSL CRP, organized by MSL.

#### **Workshop:**

Small-scale discussion meeting on a focused topic to promote MSL CRP, organized by MSL.

### **\* Award for Outstanding Researchers**

The MSL Award for Research will be presented to the outstanding researchers.

### **\* Financial Support for Conferencing**

MSL provides financial support for conferencing.

## **2. Qualified Applicants**

Researcher with a doctoral or an equivalent who reasonably approves the agreements on intellectual property rights with MSL. (Please see Appendix 1. the Regulation on Intellectual Property Right yielded from MSL CRP on page 9.)

(Technical staff and postgraduate students may be a collaborator for CRP.)

Project representative may apply once for International or General CRP, and once for International Workshop or Workshop, at most.

## **3. How to apply**

Prior to application, applicant should consult with MSL faculties regarding research subject, period, and expenses, etc.

General information of MSL including organizations, faculty members, and research abstracts, can be obtained in MSL website (<http://www.msl.titech.ac.jp/english.html>).

### **International CRP, General CRP and Topic-Specified CRP:**

Applicant should submit an application form (use Form 1 attached) to the office for MSL CRP by e-mail ([suishin@msl.titech.ac.jp](mailto:suishin@msl.titech.ac.jp)). The application form can be downloaded from MSL website ([https://www.msl.titech.ac.jp/english/msl\\_crp\\_en/crp\\_2021\\_en/application\\_forms\\_2021.html](https://www.msl.titech.ac.jp/english/msl_crp_en/crp_2021_en/application_forms_2021.html)).

### **International Workshop and Workshop:**

Applicant should submit an application form (use Form 2 attached) to the office for MSL CRP by e-mail ([suishin@msl.titech.ac.jp](mailto:suishin@msl.titech.ac.jp)). The application form can be downloaded from MSL website ([https://www.msl.titech.ac.jp/english/msl\\_crp\\_en/crp\\_2021\\_en/application\\_forms\\_2021.html](https://www.msl.titech.ac.jp/english/msl_crp_en/crp_2021_en/application_forms_2021.html)).

## **4. Period of Project**

### **International CRP and General CRP:**

About one year from April 10<sup>th</sup> 2021 to March 20<sup>th</sup> 2022

Research period may be extended up to a maximum of three years, provided that project representative of project should apply newly in each year.

### **International Workshop and Workshop:**

Between April 10<sup>th</sup> 2021 to March 20<sup>th</sup> 2022

## 5. Research Expenses

Necessary expenses for the CRP or Workshop may be covered in accordance to the budget allocated.  
(The airfare and public transportation fare are covered.)

## 6. Deadline of Application

January 8, 2021 (No application will be accepted later than the deadline.)

## 7. Selection and Notification

The decision shall be notified to each applicant (i.e. project representative) early in April, 2021.

## 8. Report of CRP / Workshop

After the completion of CRP or Workshop, representative of CRP or Workshop is required to submit “Report on CRP” or “Report on Workshop” to the office for CRP by e-mail (suishin@msl.titech.ac.jp).

The report should include a power point slide describing the results of CRP or Workshop.

## 9. Publication of Research Results and Others

In case of publishing the results of MSL CRP, please acknowledge the sponsorship for the collaborative research project provided by the Laboratory for Materials and Structures, and inform it to the office for MSL CRP.

Please use the following name(s), if necessary, in your acknowledgment.

1. **Laboratory for Materials and Structures, Institute of Innovative Research, Tokyo Institute of Technology**
2. **Collaborative Research Project of Laboratory for Materials and Structures, Institute of Innovative Research, Tokyo Institute of Technology**

Please note that the intellectual property rights yielded from MSL CRP are under the regulation of MSL, as stated in Appendix 1. For details of the regulation, please contact the office for MSL CRP.

## 10. Accommodation

Accommodations in Tokyo Institute of Technology are not available.

## 11. Where to submit and contact

Office for MSL Collaborative Research Projects  
Laboratory for Materials and Structures,  
Institute of Innovative Research, Tokyo Institute of Technology  
R3-27 4259 Nagatsuta-cho, Midori-ku, Yokohama 226-8503, Japan  
TEL: +81-45-924-5968 FAX : +81-45-924-5978  
E-mail: suishin@msl.titech.ac.jp  
URL: <https://www.msl.titech.ac.jp/english.html>

## **Abstracts of Topic-Specified Collaborative Research Projects**

### **Establishment of thermal expansion tuning method by using giant negative thermal expansion materials**

**Representative: Masaki Azuma**

There is a growing concern about displacement caused by thermal expansion, which is a critical issue in high-precision devices and equipment, such as optical devices, semiconductor manufacturing equipment, and space vehicles. Composite of resin and giant negative thermal expansion materials stemming from charge, orbital and spin degree of freedom of solid materials will be developed.

### **Elucidation and design of material functionalities based on computational and data science**

**Representative: Fumiyasu Oba**

It is essential to investigate the atomistic and electronic structures of materials for their understanding and design as material functionalities originate from these microscopic structures. This project aims at elucidating the relationship between the structures and functionalities in electronic materials using computational approaches such as first-principles calculations and data-science approaches. In conjunction with experimental techniques such as spectroscopy and electron microscopy, we try to obtain and utilize information at the atomistic and electronic level for the design of novel materials.

### **Development of Performance Evaluating Method of Building Structures for Controlling Damage**

**Representative: Koshiro Nishimura**

In Japan, a structural design method of buildings had been an allowable stress method before ultimate limit capacities was used. And then, it is changing to a performance evaluation method. In these days, because common use of buildings after a disaster like an earthquake is often required, engineers need to evaluate the structural performances. It is needed to evaluate not only strengths but also deformations because a large residual deformation may stop the common use of the building even if the structure keeps enough strength. The objective of this study is to develop a performance evaluating method of building structures, mainly concrete structures, for controlling damage.

### **Development of life innovation materials with assist of inverse design**

**Representative: Toshio Kamiya**

Laboratory for Materials and Structures (MSL) has conducted a trans-university joint project for developing life innovation materials, which will contribute to resolving the current social issues such as energy, resources, environment, and medical, and consequently providing sustainable and comfortable life to us. Though this project ends in FY 2020, we continue to conduct related collaboration researches. From 2021, more focus will be given to assistance by computational materials design, data science etc. Thereby we would develop novel functional materials based on our original materials and design concepts such as those utilizing unconventional structures and functions in inorganic and metal materials.

## **Development of New Functionalities in Abundant Element Materials**

**Representative: Hidenori Hiramatsu**

This is not only important but also timely to develop new functionalities with abundant element systems. The functionalities that should be targeted mainly include electronics device functionalities. Bulk synthesis and film growth study, structural, electronic and magnetic characterization, and theoretical study are all relevant for the present project.

## MSL faculties

Name, Extension Number and E-mail Address:

For calling from outside the campus, please dial +81-45-924- (Extension Number).

(Regarding the number marked with \* , please dial +81-3-5734- (Extension Number).)

MSL Faculties	Extension	e-mail address
AZUMA Masaki	5315	mazuma@msl.titech.ac.jp
AZUMA Yasuo	5341	azuma@msl.titech.ac.jp
DAS Hena	5081	das.h.aa@m.titech.ac.jp
HARA Michikazu	5311	mhara@msl.titech.ac.jp
HIRAMATSU Hidenori	5855	h-hirama@mces.titech.ac.jp
IDE Keisuke	5855/5325	keisuke@mces.titech.ac.jp
ISHIDA Takanori	5330	ishida.t.ae@m.titech.ac.jp
KAMATA Keigo	5338	kamata.k.ac@m.titech.ac.jp
KAMIYA Toshio	5357	tkamiya@msl.titech.ac.jp
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YAMAMOTO Takafumi	5360	yama@msl.titech.ac.jp
YASUI Shintaro	* 2906	yasui@lane.iir.titech.ac.jp

**(Excerpt) Equipment Available for Collaborative Research  
at the Laboratory for Materials and Structures  
[MSL Faculties to contact]**

<b>Equipment</b>	<b>Staff</b>
High-pressure synthesis apparatus SQUID Magnetometer ( MPMS ; Quantum Design ) High pressure synthesis apparatus (250 ton-press) Physical Property Measurement System Under High Magnetic Field Atomic Force Microscopy System X-RAY DIFFRACTOMETER	AZUMA Masaki YAMAMOTO Takafumi
Capillary gas chromatography High performance liquid chromatography Electron Spectroscopy for Chemical Analysis Infrared Spectrometer	HARA Michikazu KAMATA Keigo
SQUID Magnetometer ( MPMS ; Quantum Design ) High-Resolution Solid-State NMR Spectrometer (BRUKER AVANCE III HD) Single-Crystal Four-Circle Diffractometer X-ray Powder Diffractometer <sup>3</sup> He- <sup>4</sup> He Dilution Refrigerator	KAWAJI Hitoshi
2000kN Dynamic Loading Actuator 200tf Universal Testing Machine 500kN Temperature Variable High Rigidity Material Testing Machine Multi-Dimensional Long Stroke Loading System Reaction Frame (1000kN and 500kN Oil Jacks)	KISHIKI Shoichi
DATA LOGGER TDS630, Tokyo Sokki Kenkyujo Servo controlled static hydraulic pump and controlling units 4MN hydraulic jacks	KONO Susumu
Scanning Electron Microscope	MAJIMA Yutaka
Sub-10-fs time domain spectroscopy system Femtosecond time-domain spectroscopy system	NAKAMURA Kazutaka
Equipment for single crystals growth Equipment for physical properties evaluation under extreme conditions	SASAGAWA Takao

\* There is other equipment available for CRP.

### Maximum budget for individual grants

Type of CRP	Category	Maximum Allocation	
		Travel	Materials and Supplies
International CRP	*A	¥ 1,000,000	¥ 400,000
	B	¥250,000	¥ 40,000
	C	¥ 150,000	¥ 30,000
General CRP	*A	¥ 650,000	¥ 400,000
	B	¥200,000	¥ 40,000
	C	¥ 100,000	¥ 30,000
International Workshop, Workshop		¥ 600,000	¥ 120,000

\* Project representative may apply once for International or General CRP, and once for International Workshop or Workshop, at most.



## **Appendix 1: Regulation on Intellectual Property Right Yielded From MSL CRP**

### **•Case of researchers who belong to universities**

In general, the yielded right shall belong to the researcher or his/her institute/university. In case when the contributions from researchers of Tokyo Tech to the invention you are to file as an intellectual property are recognized to be significant, Tokyo Tech shall discuss with you the property right.

When you file patents and/or intellectual property rights yielded from MSL CRP, you shall provide us at the office for MSL CRP with a copy of the filing/filed documents. (The office for MSL CRP shall strictly storage the copy and keep the secrecy of your filing.)

### **•Case of those other than afore-defined**

In general, the yielded right shall belong to the researcher (of this category) or his/her institute/company. In case when the contributions from researchers of Tokyo Tech to the invention you are to file as an intellectual property are recognized to be significant, Tokyo Tech shall discuss with you the property right.

When you file patents and/or intellectual property rights yielded from MSL CRP, you shall provide us at the office for MSL CRP with a copy of the filing/filed documents. Moreover, in case when profits from the utilization of the filing/filed intellectual properties are anticipated, Tokyo Tech shall discuss with the right holder the consideration of the utilized facility at Tokyo Tech. (The office for MSL CRP shall strictly storage the copy and keep the secrecy of your filing.)