

# **Investigating R&D Committee on Application of Informatics in the Creation of Superconducting Materials**

Technical Committee on Metal and Ceramics

## **1. Objective**

The objective of this technical committee is to investigate the application possibilities of informatics in the creation of superconducting materials, which is a major issue in the high-throughput creation of superconducting materials.

## **2. Background and internal and external research activities**

Superconducting materials have the remarkable property of zero electrical resistance, and are indispensable source materials for future energy power generation such as nuclear fusion, energy conservation owing to reduction of transmission loss, and developing medical equipment for healthcare in areas where strong magnetic fields are utilized (i.e., MRIs, NMRs). As mentioned above, various applications are expected; hence, it is important to create superconducting materials that suit these applications. Recently, studies have been actively conducted on materials informatics (MI), which is the development of novel materials using informatics technology based on machine and deep learning. To search for superconducting materials with novel functions, in addition to leveraging on their own perspectives based on conventional experience and intuition, researchers are also collecting data from various approaches, such as experimental data and calculated values from simulations, and conducting this search with predictive models. Furthermore, in the field of measurement, efforts in measurement informatics, which lead to optimal solutions without relying on artificial subjectivity, such as spectral analysis using sparse modeling and the Bayesian optimization of analysis conditions, are also garnering considerable attention as data-driven research. Moreover, multi-screening by combinatorial methods and evaluation systems for high-throughput experiments are being utilized in experimental methods. In the superconducting materials field, attempts are also being made to incorporate the aforementioned data-driven research methods. In this survey, we will discuss informatics application possibilities, investigating broadly process informatics for material fabrication in the trial stage, from the most advanced material informatics field(s), as well as requests from industries for application.

## **3. Investigative matters**

The following items will be investigated and examined for the above fields.

- (1) Survey on the current status of machine learning searches for novel superconductors
- (2) Survey on the current status of data mining methods
- (3) Feasibility study on process informatics possibilities
- (4) Feasibility study on applications in superconducting wire  $I_c$
- (5) Survey on trends in industrial requirements for applications

## **4. Expected effects**

To identify the latest research and development trends in the application of informatics in the field of metallic and ceramic materials:

Clarifications of specifications are required for the application of informatics in the creation of superconducting materials

Clarifications regarding suitability are also expected for material creation, business potential, marketability, and the status of securing domestic and overseas intellectual property.

## 5. Term of investigation

January 2022 to December 2023

## 6. Committee members

Position	Name	Affiliation	Member/Non-member category of IEEJ
Chairperson	Akiyasu Yamamoto	Tokyo University of Agriculture and Technology	Member
Member	Mitsuru Izumi	National Institute of Technology, Toba College	Member
"	Tetsuya Ida	Tokyo University of Marine Science and Technology	Member
"	Ataru Ichinose	Central Research Institute of Electric Power Industry	Member
"	Yusuke Ichino	Aichi Institute of Technology	Member
"	Akira Iyo	National Institute of Advanced Industrial Science and Technology	Member
"	Genzo Iwaki	Hitachi, Ltd.	Member
"	Toshinori Ozaki	Kwansei Gakuin University	Member
"	Yukari Katsura	National Institute for Materials Science	Non-member
"	Shinya Kawashima	Kobe Steel, Ltd.	Non-member
"	Yusuke Shimada	Tohoku University	Member
"	Yutaka Terao	The University of Tokyo	Member
"	Kiyoshige Hirose	Furukawa Electric Co., Ltd.	Member
"	Shinji Fujita	Fujikura Ltd.	Non-member
"	Tomoya Horide	Kyushu Institute of Technology	Non-member
"	Akiyoshi Matsumoto	National Institute for Materials Science	Member
"	Nobuyuki Yoshikawa	Yokohama National University	Member
Secretary	Nobuya Banno	National Institute for Materials Science	Member

In addition to the above mentioned committee members, a separate task force (WG) will be established to facilitate the investigation activities.

## 7. Activity schedule

Committee meetings: 3 times/year

## 8. Reporting format

The results obtained via the survey conducted by the Technical Committee will be compiled as a special issue of the journal or divisional journal, or compiled as a technical report of the IEEJ.