

Greetings from Director General of NMIJ

First, we would like to express our sincere gratitude for your continued support on our activities.

As of this April, the National Institute of Advanced Industrial Science and Technology (AIST) has embarked on a 7-year, 6th Medium-To-Long-Term Plan. Together with our affiliate, AIST Solutions Inc. (AISol), we will continue to pursue research and development in science and technology, as well as the social implementation of our results, to contribute to the advancement of Japan's economy and society.

As the National Metrology Institute of Japan (NMIJ), we are aiming at leveraging the measurement technologies, achieved through the development and dissemination of our measurement standards, as well as our expertise in standardization and quality system, to strengthen open innovation, build ecosystems, and create new businesses. NMIJ is transforming its role from disseminating metrology standard to solving problems through measurements. We do hope to collaborate with you to solve the problems you face. We will also uninterruptedly provide our essential services, namely, the inspection of verification standards, the calibration and testing, the distribution of certified reference materials, and the metrology training.

When we look overseas, it is obvious that under the major shifts in national policies, domestic-first protectionism is increasingly dominating the economic strategies. However, the equivalence of measurement standards is always fundamental to every aspect in economy, industry, and science. NMIJ is committed to promote the establishment of measurement standard equivalence through international cooperations and international comparisons, in line with the guidance from relevant government ministries and the needs from industries.

The year 2025 marks the 150th anniversary of the signing of the Meter Convention in Paris, France, on May 20, 1875, which aimed to unify international measurement standards. In the same year of Meter Convention 1875, Japan promulgated the Measurement Control Ordinance, the basis for the current Measurement Law, indicating that the unification of units became increasingly important in Japan.

In 1885 Japan joined the Meter Convention, originally signed by seventeen countries, and received the meter standard and kilogram standard in 1890.



Early ratification to the Meter Convention and acquisition of these standards contributed significantly to the national development. The adoption of internationally unified units, the International System of Units (SI), over the past 150 years has enabled the realization of current advanced science and technology, safe and secure trade, and efficient commerce. Once again, we do respect our predecessors who achieved the international unification of weights and measures at that time. Recognizing the role that measurement standards have played in science and technology, industry, and daily life, as well as the importance of international cooperation for maintaining and developing the measurement standards, we would like to take a new step forward with you toward the future of measurement science, including quantum measurement technology and digitalization.

We appreciate your continued support and cooperation.



Dr. USUDA Takashi

Executive Officer, AIST
Director General, NMIJ

Organization and management team of NMIJ

NMIJ is composed of four Research Institutes: Engineering Measurement (RIEM), Physical Measurement (RIPM), Material and Chemical Measurement (RIMCM), and Measurement and Analytical Instrumentation (RIMA), Center for Quality Management of Metrology (CQMM), Research Planning Office of NMIJ and Collaboration Promotion Office of NMIJ.

The important missions of NMIJ are to develop, maintain and disseminate measurement standards, and to conduct research and development of measurement technologies, both of which are the areas being expected to make remarkable progress as an infrastructure for industrial science and technology.



Dr. HOSAKA Kazumoto
Deputy Director General



Dr. OTA Akihiro
Director of RIEM



Dr. NAKANO Tohru
Director of RIPM



Dr. INAGAKI Kazumi
Director of RIMCM

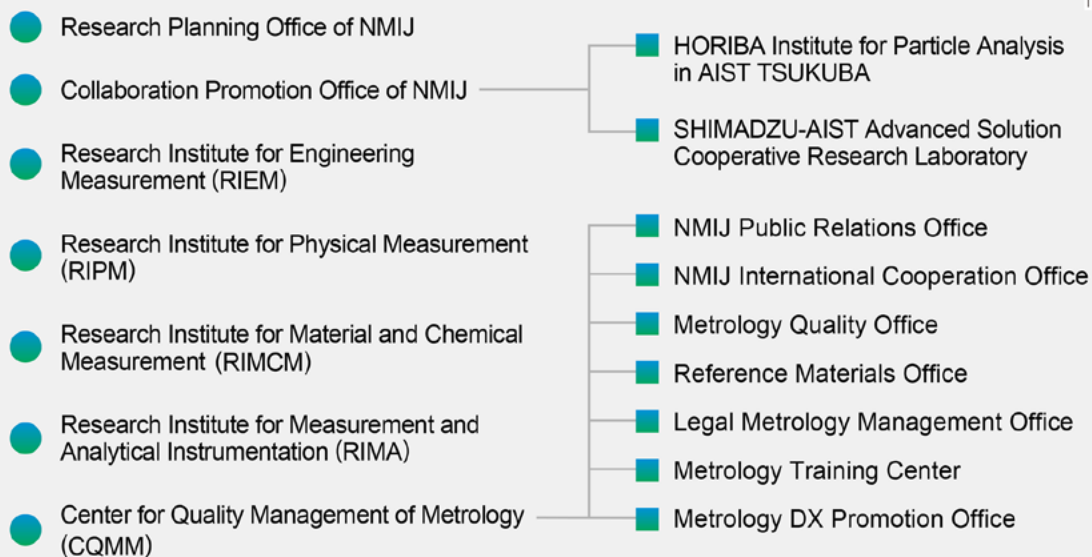


Dr. GONDA Satoshi
Director of RIMA



Dr. TAKETOSHI Naoyuki
Director of CQMM

National Metrology Institute of Japan



Research Topics

Automatic detection of diagnosis information in lung ultrasonography using artificial intelligence

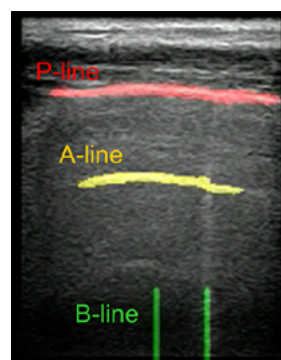
UCHIDA Takeyoshi, TANAKA Yukimi

Lung diagnostics via ultrasonography, known as lung ultrasonography (LUS), is useful for diagnosing lung lesions in conditions such as pneumothorax and pneumonia. LUS is a special diagnosis tool that uses the movement of pleura and artifacts derived from pleura to diagnose lung lesions. Use of this tool has led to a chronic shortage of skilled clinical practitioners who can correctly interpret diagnosis information in LUS videos, thereby hindering widespread use of LUS.

In order to support and educate inexperienced clinicians, we studied artificial intelligence (AI) systems which can be used to detect diagnosis information in LUS and solve problems associated with chronic shortages of skilled practitioners. We successfully developed an AI system which automatically detects diagnosis information such as the P-line (position of pleura), A-line (multiple reflections between ultrasound probe and pleura), and B-line (diagnosis information of pneumonia). In addition, conversion of lung sliding (pneumothorax diagnosis information) videos into two-dimensional data has successfully enabled automatic, accurate, and rapid lung sliding detection by our AI system. Inexperienced clinicians can perform LUS examinations while using diagnosis information from our AI system as a reference. Our AI system can help to mitigate the shortage of LUS medical experts and can also be applied to educational purposes.

Reference: T. Uchida et al., *Heliyon* **10**, e34700, 2024
<https://doi.org/10.1016/j.heliyon.2024.e34700>

Automatic detection of diagnosis information in lung sonography by our developed AI



Automatic detection of P-line, A-line, B-line by AI system



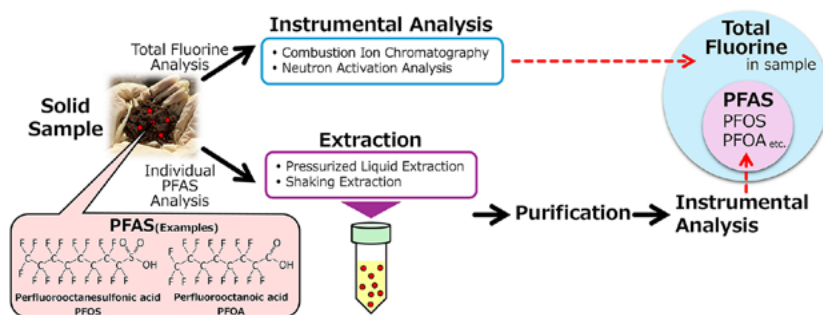
Automatic detection of lung sliding by AI system

Initiatives to develop analytical methods for per- and polyfluoroalkyl substances (PFAS)

YAMAZAKI Eriko and HANARI Nobuyasu

Per- and polyfluoroalkyl substances (PFAS) have drawn worldwide attention in recent years. Consequently, it is urgent to understand their environmental impact, dynamics, and product-related emissions. NMIJ is working on the development of certified reference materials (CRMs) and analytical methods to obtain reliable measurements of PFAS in various matrices. In particular, the development of analytical methods for PFAS in solid matrices requires the extraction of target analytes from solids into solvents, which is a complicated and time-consuming procedure. We are therefore focusing on pressurized liquid extraction, a method that automatically extracts PFAS from solids in a short time using small amounts of solvents under high temperature and pressure conditions, and are optimizing the conditions to enable efficient extraction of multiple PFAS. In the future, we will expand the target to around 30 compounds and verify the effectiveness of this method by comparing it with the shaking extraction technique used in the domestic official method. Moreover, given the current focus on the need to manage the total fluorine content of PFAS, we have also started to evaluate the quantitative assessment and characterization of total fluorine content using PFAS CRM.

Reference: Hanari et al., *Bunseki Kagaku* **74**, 7, 2025 (in Japanese)
<https://doi.org/10.2116/bunsekikagaku.74.7>



Different extraction and instrumental approaches for determination of PFAS and total fluorine content

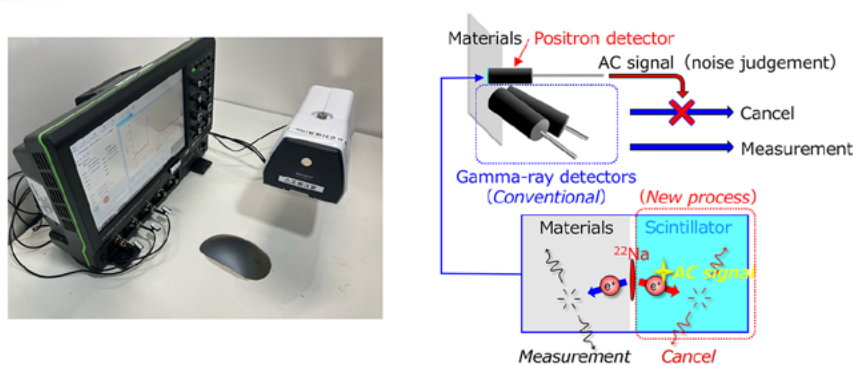
Development of a portable positron annihilation lifetime measurement system

YAMAWAKI Masato

A positron, the antiparticle of an electron, annihilates with an electron emitting gamma-rays. The positrons are trapped in the intermolecular spaces or lattice defects within the material, and the mean lifetime of the positrons is longer. A positron annihilation lifetime measurement is an analytical method which uses these unique characteristics.

Since material destruction is caused by microscopic damage on the atomic or molecular scale, the positron annihilation lifetime measurement can also estimate the degree of material degradation. Therefore, we developed a portable positron annihilation lifetime measurement system through a joint research project in collaboration with a company (TOYO SEIKO CO., LTD.) and the METI Monozukuri R&D Support Grant Program for SMEs Grant Number JPJ005698. The key technology of this measurement system is the signal-processing "Anti-Coincidence (AC) method," enabling measurement with one sample, instead of two required to sandwich a ^{22}Na positron source. This technology makes it possible to measure without cutting out the sample, thus enabling on-site positron lifetime measurements. We are currently in the process of developing a portable measurement system which uses machine learning and other emerging technologies to inspect infrastructure degradation.

Reference: M. Yamawaki et al., *Jpn. J. Appl. Phys.* **61**, 066503, 2022, <https://doi.org/10.35848/1347-4065/ac65ca>



The portable positron annihilation lifetime measurement system (left), and overview of the Anti-Coincidence method (right).

Featured Topics

150 years since the Meiji government's first Weights and Measures Control Ordinance

On August 5, 1875, Japan's first modern law on weights and measures, the Ordinance on the Control of Weights and Measures, was promulgated. This year marks the 150th anniversary of that ordinance.

Ten years later, in 1885, Japan formally joined the Metre Convention and became part of the global metrology community.

At the first General Conference on Weights and Measures (CGPM), held in 1889, the establishment of national standards of the metre and the kilogram was approved. In the following year, Japan received its national standards of the metre (No. 22) and the kilogram (No. 6). These instruments have greatly contributed to the advancement of science, technology, and industry as the measurement standards in Japan.



Left: National Standard of the kilogram [No. 6] Right: National Standard of the metre [No. 22] (both housed at NMIJ)

Currently, the Metre Convention has established the International System of Units (SI), which defines seven fundamental units: time (second), length (metre), mass (kilogram), electric current (ampere), thermodynamic temperature (kelvin), amount of substance (mole), and luminous intensity (candela).

[More details on this article](#)

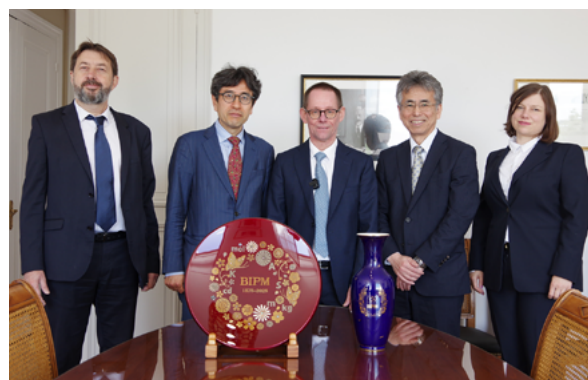
Presentation of “Nano-Composite Coating *Tamamushi* Lacquered Commemorative Plate”

The Metre Convention was first signed in 1875 by 17 nations, laying the foundation for international collaboration in metrology. Ten years later, in 1885, Japan formally joined the Convention and became a part of the global metrology community.

In recognition of the 150-year history, through which Japan has benefited immensely from international cooperation under the Metre Convention, and in acknowledgment of the essential role Japan has played, AIST prepared a commemorative gift as a token of appreciation to mark this historic milestone. The gift is a large lacquerware plate with a *Tamamushi-nuri* clay nanocomposite coating, developed by AIST Tohoku. It was presented to the BIPM at the Embassy of Japan in Paris, and later unveiled to related parties at the BIPM in Sèvres.

The surface features hand-painted *maki-e* artwork using lacquer, mother-of-pearl, silver powder, and gold powder, depicting SI units along with motifs of Japanese flowers and butterflies.

In Western cultures, butterflies are presentations of good fortune. Here, they reflect our shared hopes for the future of the Metre Convention and the continued advancement of measurement science. We believe that this piece, which created new added value through combinations of Japanese century-old lacquerware techniques with advanced materials technology, is truly fit to commemorate this important milestone in the ever-evolving history of the Metre Convention.



At BIPM Sèvres with the commemorative plate
From left, Dr. Gressier, BIPM, Mr. Kataoka, Vice-president, AIST, Dr. Milton, Director, BIPM, Dr. Usuda, Director general, NMIJ/AIST, Dr. Cypionka, BIPM

Greetings from the new APMP EC



AKOSHIMA Megumi
APMP EC Member

The Executive Committee (EC) of the Asia-Pacific Metrology Program (APMP) is responsible for oversight of the strategic direction and governance of the APMP. The Committee is composed of seven members, including the APMP Chair. Dr. Wei-En Fu of CMS/ITRI and Dr. Takehiro Morioka of NMIJ departed from the Committee in November 2024, following which I joined as a new member.

I have been a member of the Technical Committee on Thermometry (TCT) focusing on thermophysical quantities since 2012. As a member of the EC, I am mainly responsible for liaising with the TC chairs, Technical Committee Initiatives (TCI), and Focus Group Initiatives (FGI) in EC. TCI and FGI are programs that support APMP members in collaborating with national metrology institutes establishing the CIPM MRA, sharing technologies and resources, and investigating technical capabilities, issues, and needs from the view of measurement. I will do my best to ensure the metrology infrastructure in the Asia-Pacific region. Thank you very much for your support.

Greetings from TCPR chair

It is a great honor to have been elected as the next TCPR (Technical Committee for Photometry and Radiometry) chair in APMP. I would like to take this opportunity to extend my heartfelt gratitude to APMP colleagues for giving me the chance to contribute to APMP.

During my term as the TCPR chair, I intend to focus on two key issues. First, I would like to deepen discussions on the future of photometry. I believe photometry is at a critical turning point. In response to an international proposal for a new spectral luminous efficiency function, which serves as a fundamental component of the photometric system, significant global attention has been drawn to its implications, including the possibility of revising the definition of the candela. Additionally, the decreasing availability of conventional standard lamps necessitates the development of a novel photometric system which either incorporates a new standard source or reduces dependence on standard sources.

My second focus will be further promotion of international research collaboration. Closer cooperation among member organizations is essential for strengthening TCPR's technical capabilities, enhancing its international presence, and enabling meaningful contributions to address technical challenges in our field.

I look forward to working closely with all of you. Thank you for your kind support and cooperation.



SHITOMI Hiroshi
TCPR chair

Visit by the Chief Metrology Officer from the Federal Institute of Metrology Switzerland (METAS)

On October 3–4, 2024, Dr. Peter Blattner, Chief Metrology Officer of the Federal Institute of Metrology (METAS), Switzerland, visited NMIJ with two METAS researchers. After meeting with NMIJ leaders, including Dr. USUDA Takashi, Director General of NMIJ, and Dr. KOBATA Tokihiko, Deputy Director General of NMIJ, they took part in discussion with NMIJ experts for a concrete partnership.

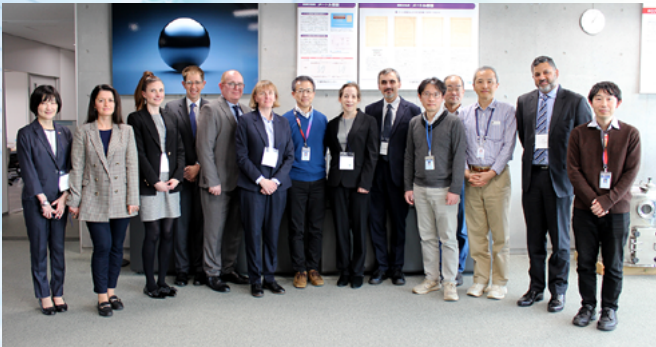
Dr. Blattner visited several NMIJ laboratories, including the flow standard facility in the North Site. These visits facilitated meaningful exchanges of ideas and strengthened hopes for future collaboration between the organizations.



Group photo at NMIJ, AIST with, second from the left, Dr. Peter Blattner, Ms. Konstantina Vasilatou, and Mr. Kevin Auderset.

Delegation Visit from NPL and NPNT0, United Kingdom, to NMIJ

On December 4, 2024, delegates from the National Physical Laboratory (NPL, UK) and the National Positioning, Navigation and Timing Office (NPNT0, UK) visited NMIJ. The delegates from NPL included Dr. Leon Lobo (Head of the National Timing Centre) and four other personnel, while the delegates from NPNT0 included Mr. Michael Pigott (Deputy Head) and two other personnel. Three laboratories working on the time and frequency metrology hosted these delegates during their visit. Active conversations between the delegates and hosting laboratory researchers during laboratory visits have opened up fruitful opportunities for future collaboration.



Group photo with delegation from NPL and NPNT0 at NMIJ, AIST

NMIJ Visit by Delegation from NMC, A*STAR Singapore

On February 21, 2025, a delegation from the National Metrology Center (NMC), the Agency for Science, Technology and Research (A*STAR), Singapore, visited NMIJ. The delegation included Prof. Gregory K. L. Goh (Executive Director) and four other members. An overview of NMIJ and A*STAR, followed by related discussions, was held before a laboratory tour at NMIJ.

During the visit, three laboratories from the Research Institute for Engineering Measurement and three from the Research Institute for Physical Measurement hosted the delegates. The visit fostered a lively exchange of knowledge among researchers from both institutes and opened up fruitful opportunities for future collaboration.

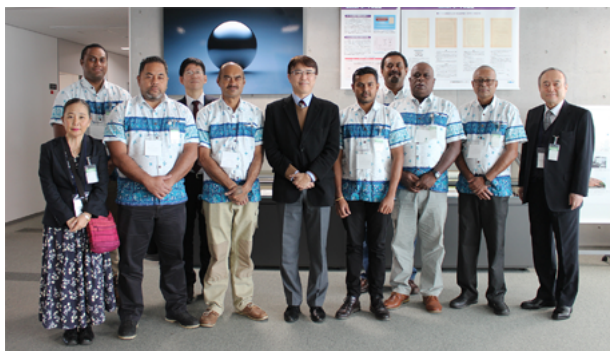


Group photo with delegation from A*Star at NMIJ, AIST

Fiji Meteorological Service (FMS) visit to NMIJ

On March 18, 2025, a delegation from Fiji Meteorological Service (FMS), under the coordination by JICA and Japan Weather Association (JWA), visited NMIJ.

After receiving an overview of NMIJ, the delegates visited three laboratories—each affiliated to the Research Institute for Physical Measurement, the Research Institute for Engineering Measurement, and the Research Institute for Material and Chemical Measurement. The laboratory visit facilitated the delegates to observe directly the standard equipment used for calibration in NMIJ and to have knowledge from the experts, especially those related to weather measurements: temperature, gas pressure and humidity. This visit is believed to be a fruitful contribution to the future improvement of the FMS.



Group photo with delegation from FMS at NMIJ, AIST

Renewal of MOU between NIM and NMIJ



Dr. Wentao Li, Director General, NIM (left)
Dr. USUDA Takashi, Director General, NMIJ (right)

On March 24, 2025, the Memorandum of Understanding (MOU) between the National Institute of Metrology of China (NIM China) and the National Metrology Institute of Japan (NMIJ) was renewed.

For 15 years, NMIJ has been working with NIM China under an MOU initially signed in 2010.

The renewed MOU continues this collaboration, focusing on activities such as international comparisons and the exchange of young researchers.

This renewal is expected to strengthen the presence of both institutes in the CIPM and APMP activities, as well as to accelerate the development of the entire field of measurement and metrology.

NIMT visit to NMIJ

Delegation from the National Institute of Metrology Thailand (NIMT), which included Pol.Lt.Gen. Pornchai Suteerakune, Director, Mr. Anusorn Tonmueanwai, Deputy Director, and five other delegates, visited NMIJ on April 11, 2025. After receiving an overview of NMIJ, the delegation was split into two groups for laboratory visits to two different sites: the NMIJ and the Global Research and Development Center for Business by Quantum-AI technology (G-QuAT). Three laboratories affiliated to the Research Institute for Material and Chemical Measurement and one affiliated to the Research Institute for Engineering Measurement hosted the visit group in NMIJ site. Active knowledge exchange has occurred between the delegates and hosting laboratory researchers during the laboratory visits, implying some fruitful opportunities for future cooperation. A wrap-up meeting closed the present NMIJ visit.



Group photo with delegation from NIMT at NMIJ, AIST

Visit by the Department of Internal Trade (DIT), the Kingdom of Thailand

On April 22, 2025, the National Metrology Institute of Japan (NMIJ) hosted a visit of a delegation from the Department of Internal Trade (DIT), the Kingdom of Thailand, which includes Mr. Wittayakorn Maneenetr, the DIT Director, Mr. Udom Srisomsong, the DIT Deputy Director, and four other representatives, under the coordination by Tatsuno Corporation.

After receiving an overview of NMIJ, the delegation visited three laboratories at the Research Institute for Engineering Metrology (RIEM) which are involved in type approval testing in the field of legal metrology. During the laboratory visits, a lively exchange of knowledge took place between the delegation and NMIJ researchers on topics related to non-automatic weighing instruments, water meters, and EMC testing.



Group photo with delegation from DIT at NMIJ, AIST

This visit is expected to strengthen the future collaboration involving NMIJ, relevant legal metrology institutes, and the DIT of the Kingdom of Thailand.

Selected Research Reports

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- 2) Y. Kondo, A. Hirai, T. Katsube, N. Kawashima, Y. Bitou, "Two-point diameter calibration of a sphere by a micro-coordinate measuring machine using a silicon gauge block as a reference standard," *Precision Engineering* **92**, 167, 2025,
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- 8) T. Kobayashi, D. Akamatsu, K. Hosaka, Y. Hisai, A. Nishiyama, A. Kawasaki, M. Wada, H. Inaba, T. Tanabe, T. Suzuyama, F.-L. Hong, M. Yasuda, "Generation of a precise time scale assisted by a near-continuously operating optical lattice clock," *Physical Review Applied* **21**, 064015, 2024,
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- 11) T. Shiga, T. Yagi, H. Fujihisa, "Structural phase transitions of Mg₂NiH₄ induced by NiH₄ molecular ion distortion and metal Lattice Deformation under High Pressures," *Inorganic Chemistry* **63**, 21121, 2024,
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