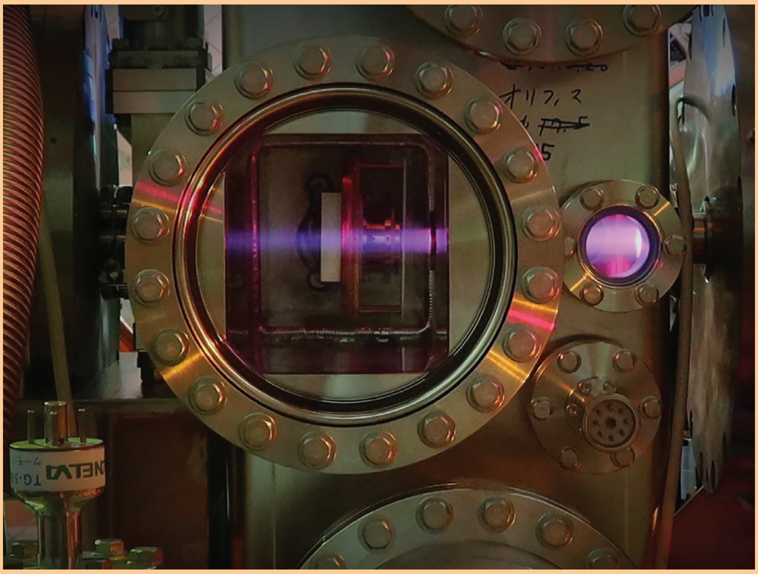
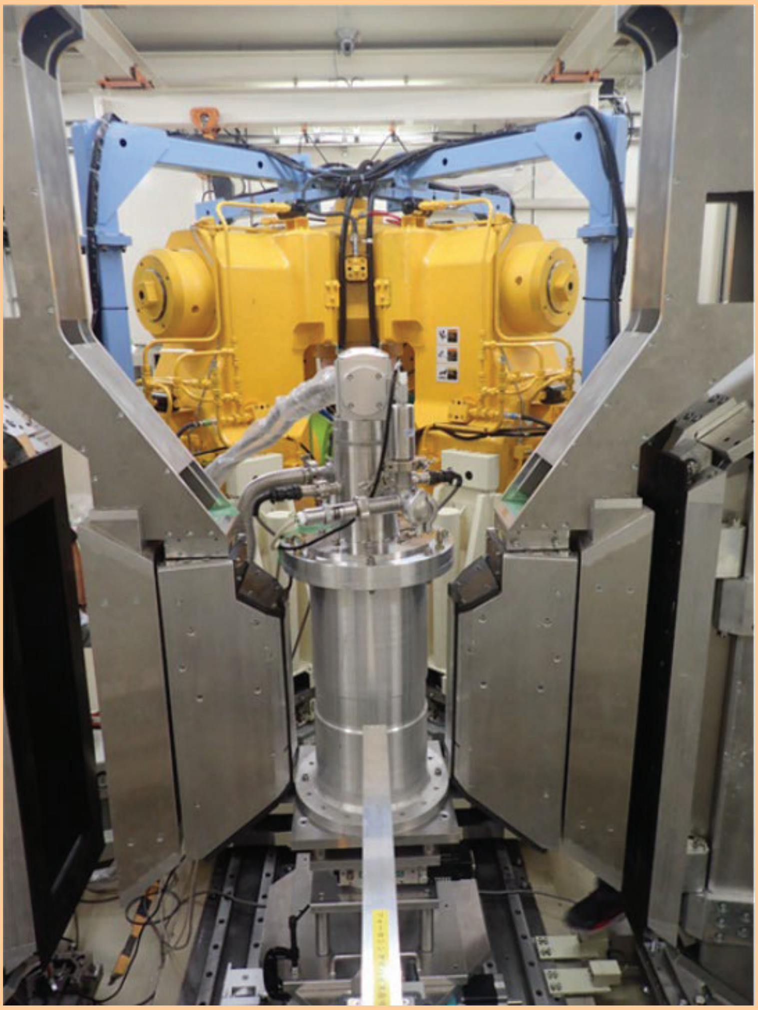
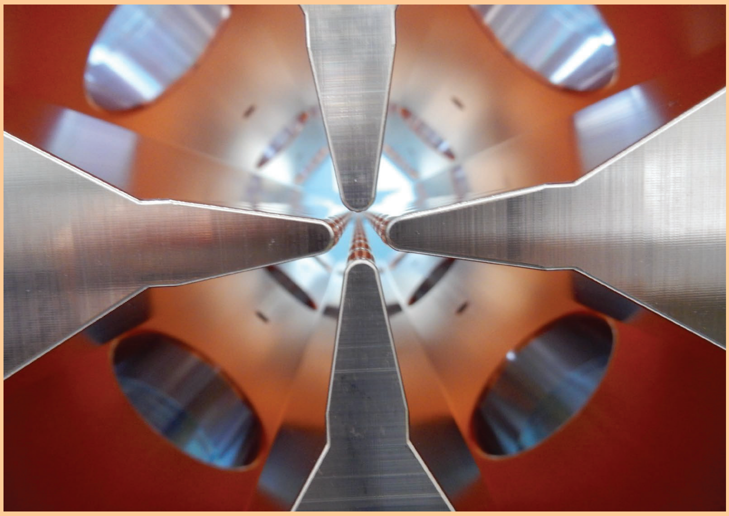


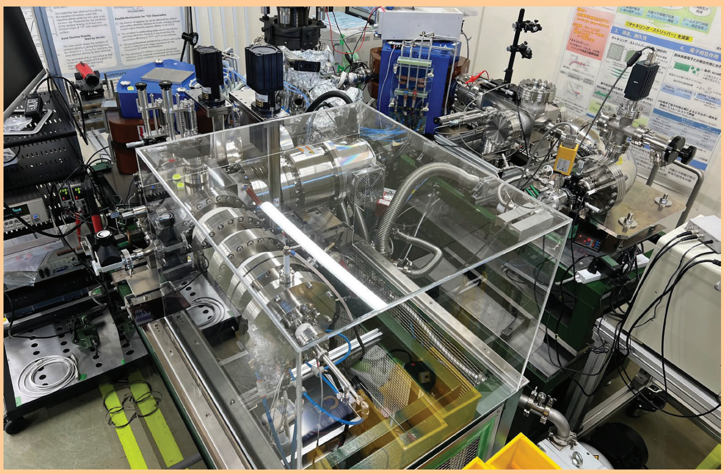
JAEA

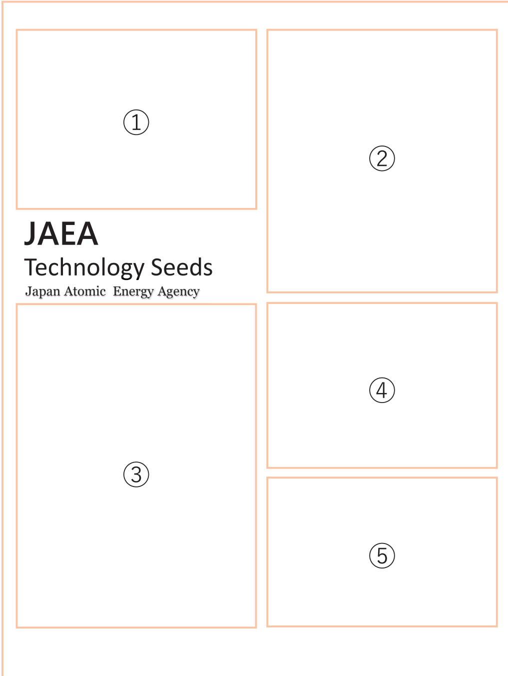
Technology Seeds

Japan Atomic Energy Agency









＜Cover photo＞

① Origin of the lights of J-PARC (photo by Takanori Shibata)

This is an image of a negative hydrogen ion (H-) beam pulled out from the ion source, which is the starting point of J-PARC. The ion source generates a plasma state by injecting hydrogen gas and a radio-frequency electric field into its interior. The ions in the plasma are extracted as a beam using a high voltage of several 10 kilovolts. The right side of the photo shows the ion source side. Near the ion source, a lot of introduced hydrogen gas remains, which emits red and purple light when it collides with the beam.

② Looking upstream from downstream (photo by Junko Kitagishi)

The J-PARC linac comprises an ion source and four accelerator cavities (RFQ, DTL, SDTL, and ACS) from the upstream side. This photo shows the accelerator tunnel where the linear accelerator components are installed, looking from downstream to upstream, spanning 330 m. The green components in the foreground are the SDTL and ACS. The green equipment in the foreground is a quadrupole magnet for focusing the beam between the SDTL and ACS.

③ Mantis aiming at butterflies (photo by Takanori Hattori)

This is a view of the low-temperature and high-pressure experiment at the BL11 high-pressure neutron diffractometer PLANET in the Materials and Life Science Experimental Facility at J-PARC. From the front to the center of the photo, neutron beams are injected to the sample in the cryostat located at the center of the experimental hatch and the scattered neutrons are measured by the detectors installed on both wings. The high-temperature, high-pressure press "ATSUHIME" behind the cryostat is waiting for its turn.

④ Radio Frequency Quadrupole (RFQ) Accelerator (photo by Masashi Otani)

This is the contents of the RFQ, one of the linac accelerator cavities at J-PARC. The principle of the RFQ was proposed in 1969 and first realized at Los Alamos, United States in 1980. Unlike other accelerators, it is capable of strong focusing, acceleration, and bunching by electric fields, and has played a crucial role in generating high-intensity beams as the first-stage part of proton and ion accelerators. At J-PARC, it is also an indispensable part of the world's top-class proton beam accelerator. In recent years, it has succeeded in accelerating muons for the first time globally.

⑤ Ultracompact accelerator mass spectrometer

This is a prototype of an ultracompact accelerator mass spectrometer. This prototype is 2 m^2, much smaller than conventional accelerator mass spectrometers.

On the publication of JAEA Technology Seeds

Japan Atomic Energy Agency (JAEA) is the only organization in Japan conducting comprehensive research and development in the field of nuclear energy. Because result of our research and development activities, various of industrially applicable technologies have been developed. Some technologies have a wide range of applications beyond the nuclear field. We have compiled a collection of technology seeds for the industry and other external parties to use.

We hope that all parties involved in companies, universities, and research institutes will use this technology seeds to understand our technologies and consider joint research and technology transfer. It would be our greatest pleasure if this collection of technology seeds could be of some use to you.

December 2023
HASHIMOTO Hiroyuki
JAEA Innovation Hub
Japan Atomic Energy Agency

Contents

Contents

New !

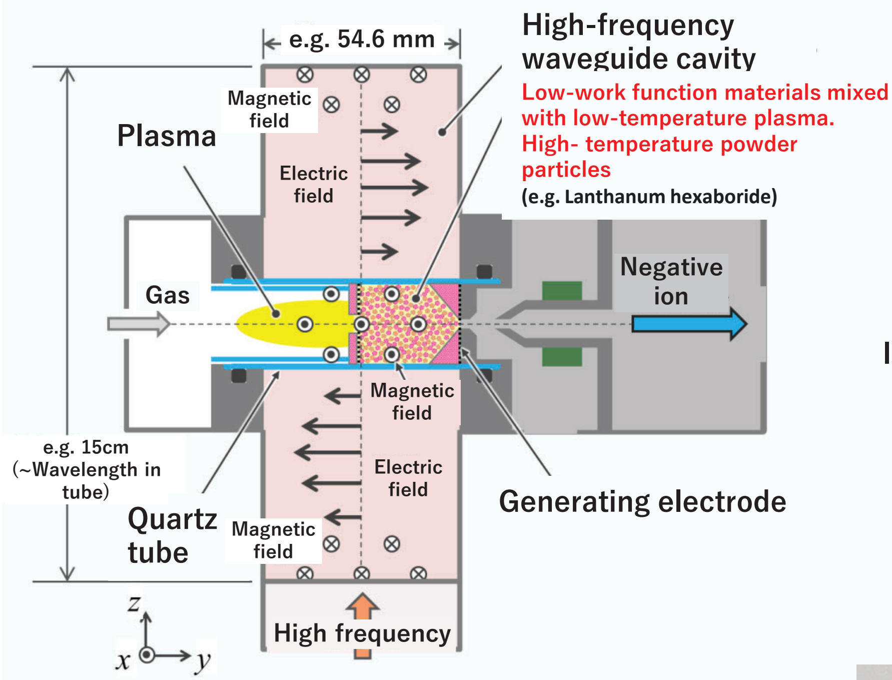
A cesium-free, compact, highly efficient, and extremely safe negative ion source

No.1

Development of a negative ion generator by high-frequency heating of powder particles

- Cesium-free and high negative ion generation efficiency
- Safe because cesium is not used for electron donors
- The negative ion generation area is increased more than 10 times compared to the conventional method.

Keywords： Negative ion source, radio frequency heating, low-work function materials, cesium-free, high efficiency



Place the powder particles of low-work function materials in the high-frequency waveguide cavity

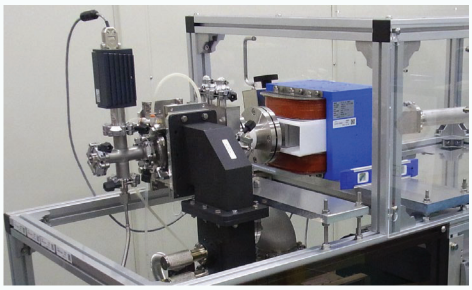
- **Powder particles are heated by eddy currents**
- **Plasma is generated**

Inject sample gas into plasma

- **Gas molecules are excited**
- **The gas molecules are contacted with low-work function material**

Highly efficient generation of negative ions

	Conventional technology	Proposed technology
Issue	Sample gas molecules collide with plasma electrons + Contact with cesium on the wall	Sample gas molecules in contact with hot powder particles of low-work function materials
	Problems ・Cesium Utilization ・Small reaction area	Advantages ・Cesium-free ・Larger reaction area



Proof-of-principle test equipment

Stage of Technology

Basic research

Applied research

Practical development

Production

Commercialization

Fields of use

・Ion beam analysis and accelerator mass spectrometry
・PET and other medical radiation fields
・Semiconductor integrated circuit fabrication processes

Information of intellectual property

Pub. No. US2023/0256408
Pub. No. EP4231325

Technical details

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Cellulose nanofiber hydrogels

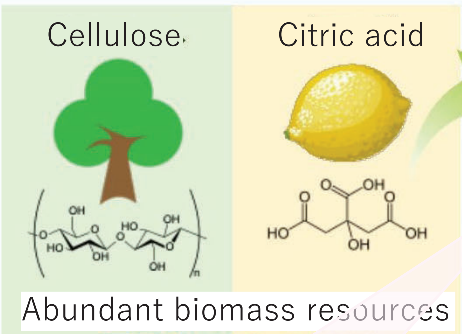
Biodegradable high-strength porous materials with high affinity with the environment and living organisms

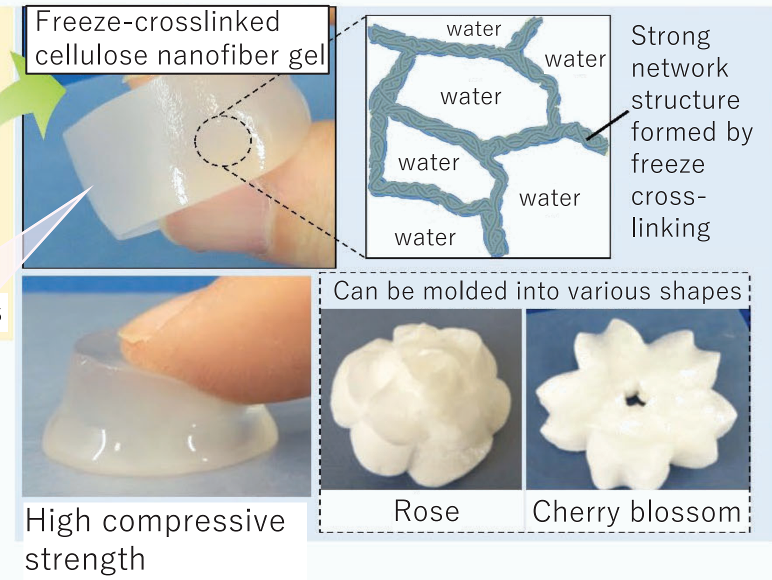
No.2

Hydrogels, and methods of producing gels or porous materials

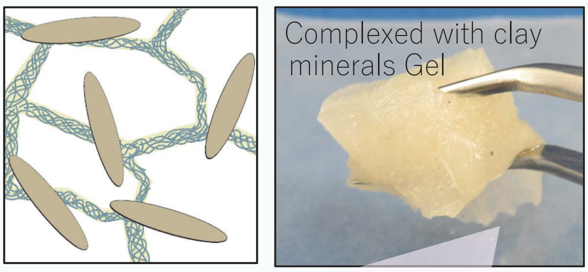
- Success in improving strength of cellulose hydrogel materials using freezing phenomena
- Characterized by biodegradability, high moldability, and adsorptivity for toxic substances
- Anticipated to be developed into environmental purification materials and biomaterials

Keywords： Biomass material, Freezing, Cellulose, Adsorption, Biodegradable, High strength, High moldability

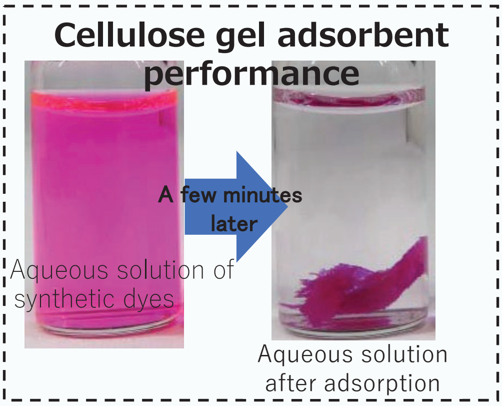




Point.1
Just freeze, mix, and melt to create



Point.2
Easily composited and molded with various powder materials such as clay minerals



Stage of Technology

- Basic research
- **Applied research**
- Practical development
- Productization
- Commercialization

Fields of use

・Decontamination in the environmental field
・Nuclear, environment, civil engineering, construction
・Cell culture, regenerative medicine

Information of intellectual property

WO2021/256038

Technical details

Contact information for inquiries　Japan Atomic Energy Agency
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Simple integrable inductor

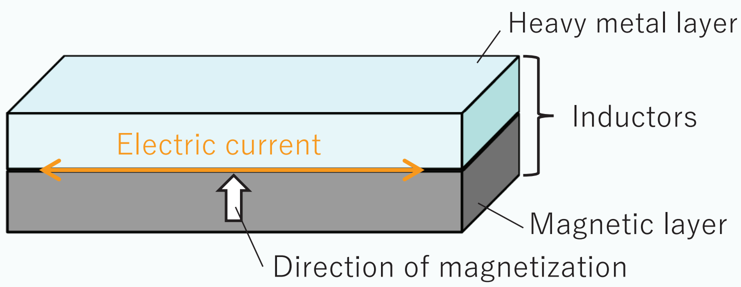
No.3

Thin-film inductor elements, thin-film variable inductor elements

- Integrable inductor that do not necessitate a coil structure
- Simple element structure with magnetic and heavy metal layers
- Electrically variable magnitude of inductance

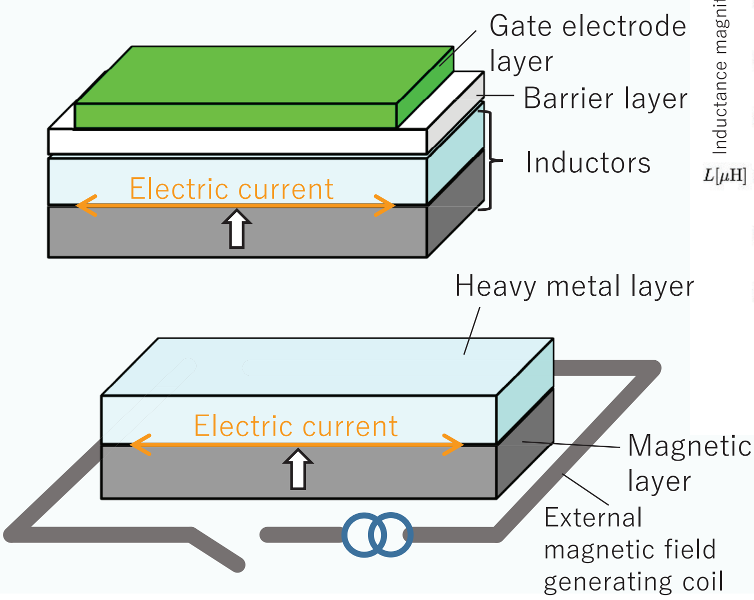
Keywords： Inductors, High-frequency applications, Noise filters, Magnetic metal thin films

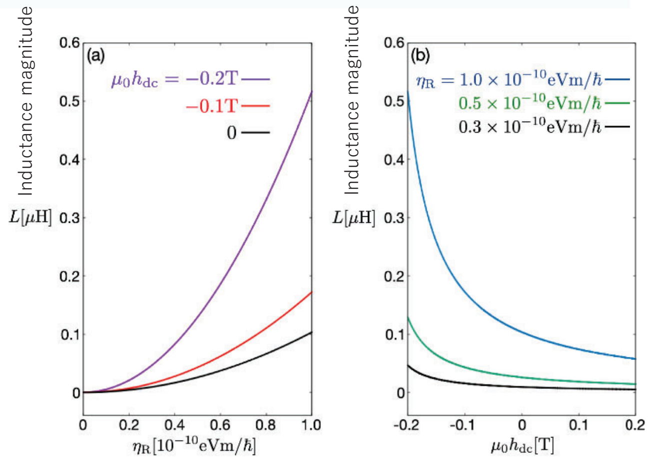
◆ Basic structure of the invention



A thin-film inductor element comprising a multilayer film of magnetic and nonmagnetic layers and a pair of electrodes to which an alternating current or a high-frequency current is applied. The inductance is inversely proportional to the cross-sectional area of the element.

◆ Variable inductor embodiment





Gate electric field magnitude　　Magnitude of external magnetic field

The magnitude of inductance varies according to the external gate electrode and external magnetic field.

Stage of Technology

- Basic research
- Applied research
- Practical development
- Productization
- Commercialization

Fields of use

・High-frequency use
・Smartphone
・Automotive automatic control

Information of intellectual property

WO2022/181069
Pub. No. TW202240610
(Co-applicant: Tohoku University)

Technical details

Contact information for inquiries　Japan Atomic Energy Agency
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Prevention of embrittlement of high-strength aluminum alloys

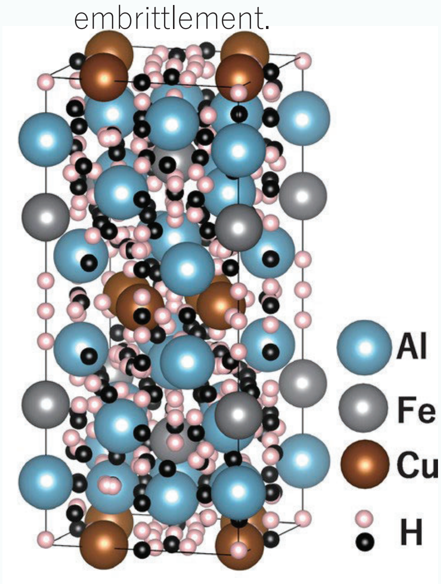
No.4

Additives that absorb hydrogen in materials and prevent hydrogen embrittlement

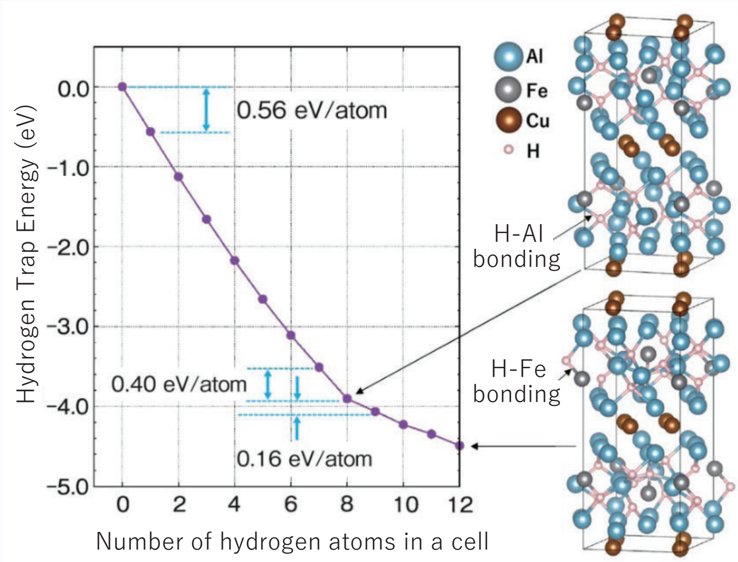
- Computational science research discovers a hydrogen-absorbing compound in aluminum alloys
- Experiments verify effectiveness in preventing hydrogen embrittlement of aluminum alloys

Keywords： Supercomputer, First-principles electronic structure calculations, Aluminum alloy, Hydrogen embrittlement

- High-strength aluminum alloys are susceptible to hydrogen embrittlement (hydrogen-induced brittleness).
- First-principles electronic structure calculations demonstrate that the Al_7FeCu_2 compound in aluminum alloys absorbs hydrogen atoms in the aluminum matrix.
- Experimental confirmation of the influence of controlling the content of Al_7FeCu_2 compound in aluminum alloys on the suppression and prevention of hydrogen embrittlement.



Possible hydrogen atom positions (H) in Al_7FeCu_2 compound



Hydrogen absorption capacity of the Al_7FeCu_2 compound in an aluminum alloy:
Although the trapping energy (eV/atom) of hydrogen atoms reduces with increasing hydrogen absorption, up to about eight hydrogen atoms are estimated to be absorbed in a cell.

Stage of Technology

- Basic research
- Applied research
- **Practical development**
- Productization
- Commercialization

Fields of use

Aluminum alloy production, metal material development

Information of intellectual property

WO2021/246267 (Co-applicant: Kyushu University)
WO2022/270483 (Co-applicant: Iwate University, Kyushu University)

Technical details

Contact information for inquiries　Japan Atomic Energy Agency
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Maintains ultra-high vacuum without power supply

No.5

Surface modification to a vacuum chamber-type getter pump

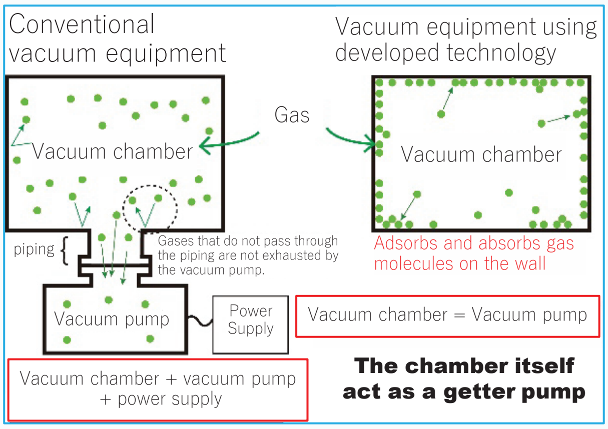
- Lightweight vacuum chamber-type getter pump
- Functions in a power-saving, space-saving, vibration-free manner
- Maintains ultra-high vacuum for long periods of time without conventional pumps

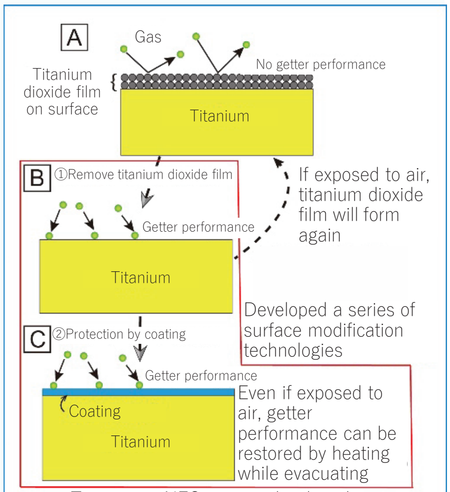
Keywords： Ultra-high vacuum, Getter pump, Vacuum chamber, Titanium, NEG coating

Energy-saving, space-saving, vibration-free vacuum chamber-type getter pump

Technology

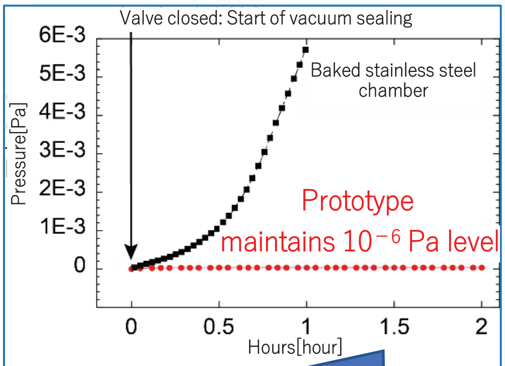
Looks like an ordinary vacuum chamber



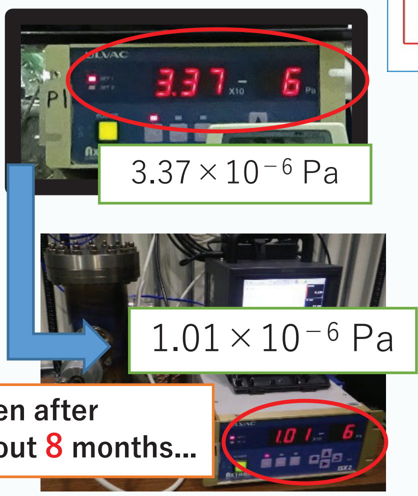


Titanium + NEG coating developed

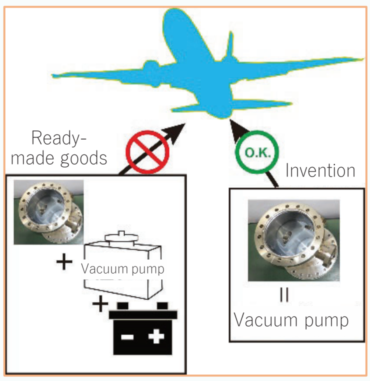
Effect



Maintains ultra-high vacuum for a long period of time without a conventional pump!



Even after about 8 months...



Enables air transportation without batteries

Stage of Technology

- Basic research
- Applied research
- **Practical development**
- Productization
- Commercialization

Fields of use

- Preserving an ultra-high vacuum during the transport of semiconductor samples
- Ultra-high vacuum for electron microscopy
- Ultra-high vacuum for analyzers

Information of intellectual property

Patent No. US11668309
Patent No. IT3945210

Technical details

Contact information for inquiries　Japan Atomic Energy Agency
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No.6

Enables measurement of γ-ray spectra without shielding in high dose-rate fields

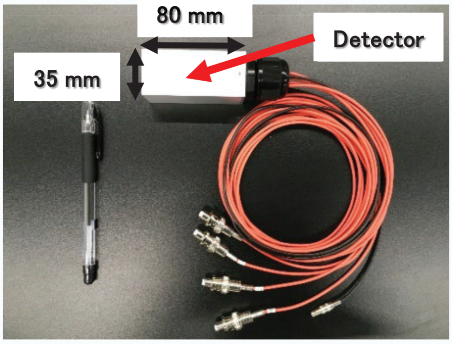
Development of γ-ray spectrometer specialized for high dose rate

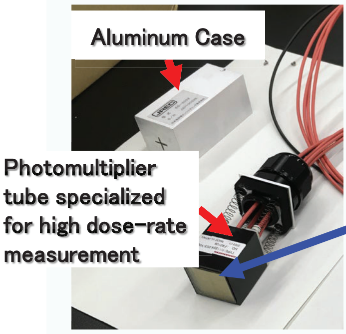
- Gamma-ray spectrum measurement in high dose rate fields (>1 Sv/h)
- Sufficient energy resolution for radionuclide analysis
- Compact and lightweight detector that demands no shielding

Keywords： γ-ray spectrum, High dose rate measurement, Decommissioning, Nuclide analysis, CeBr3, Photomultiplier tube

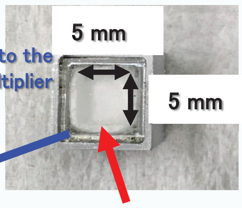
- ❑ Available for high dose-rate fields
- ❑ γ-ray spectrum measurement
- ❑ Minor radionuclide analysis by eliminating principal spectra

Compact and lightweight detector element





Coupled to the photomultiplier tube

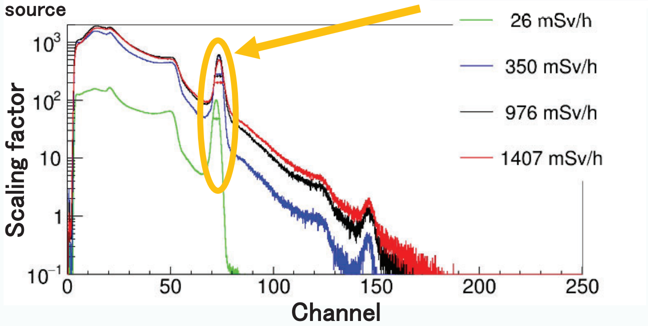


CeBr$_3$ Crystal (5 mm × 5mm × 5 mm)

γ-ray exposure test without any radiation shields

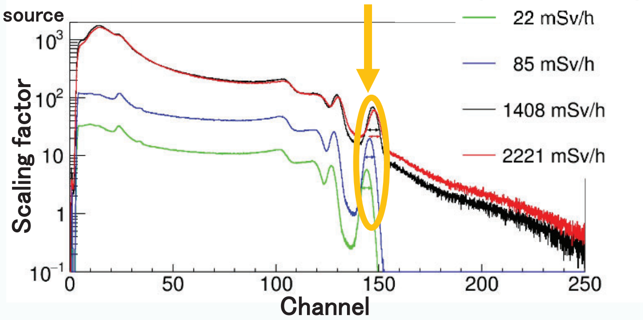
^{137}Cs radiation source

Energy resolution (662 keV)
4.2% (26 mSv/h) ⇒ **5.5% (1407 mSv/h)**



^{60}Co radiation source

Energy resolution (1333 keV)
3.1% (22 mSv/h) ⇒ **4.2% (2221 mSv/h)**



Energy resolution required for radionuclide analysis:
Identification of ^{137}Cs and ^{134}Cs : less than 8.8% at 662 keV
Identification of ^{60}Co and ^{154}Eu : less than 4.4% at 1333 keV

Construction of a spectrometer for γ-ray nuclide analysis at high dose rates exceeding 1 Sv/h

Stage of Technology

- Basic research
- Applied research
- **Practical development**
- Productization
- Commercialization

Fields of use

- Contamination monitoring in nuclear reactor and hot cell
- Nondestructive assay for radioactive waste and nuclear fuel materials

Information of intellectual property

WO2022/075455
(Co-applicant: Tokyo University)

Technical details

Contact information for inquiries Japan Atomic Energy Agency
seika.riyou@jaea.go.jp

Separate hydrogen and deuterium

No.7

Concentration and separation of hydrogen isotope gases by electrochemical methods

- Easy handling due to a usage of solid electrolyte membrane
- Efficient separation of hydrogen (H_2) and deuterium (D_2) at room temperature
- Energy-saving separation

Keywords： Hydrogen isotopes, Enrichment separation, Solid electrolyte membranes, Electrochemistry

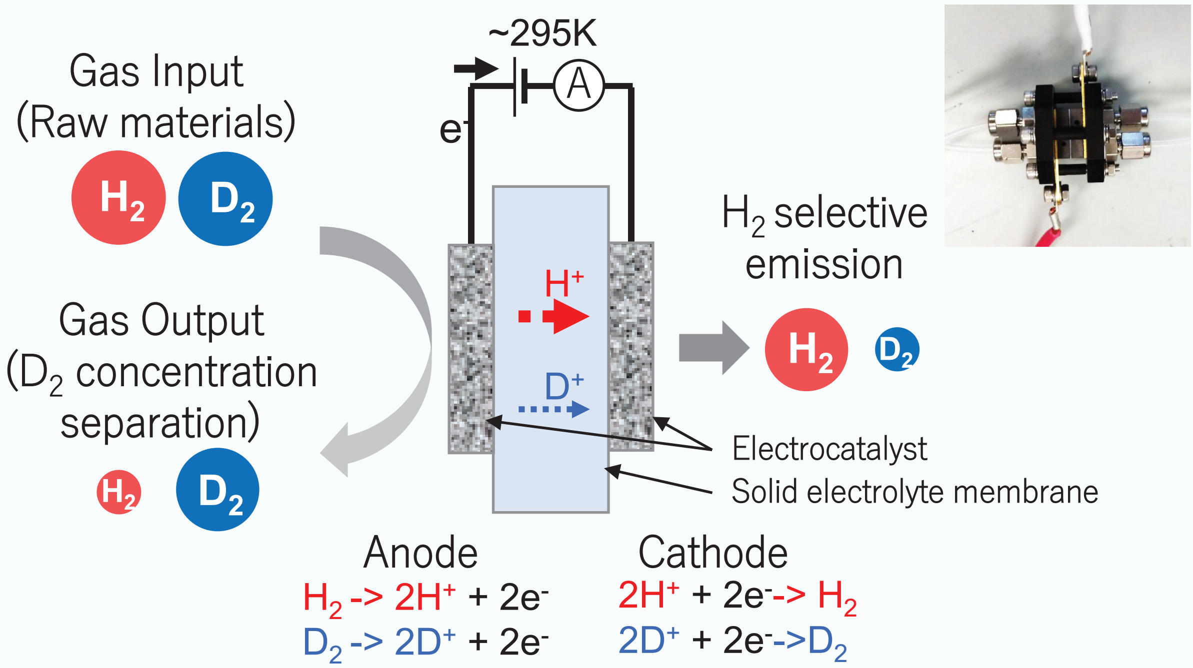
Enrichment and separation of D_2 at low cost

Conventional technology : Cryogenic distillation method

- Operates around -250° C
- Complicated system
- Low separation ability (H/D ～2)

Developed Technology : Electrochemical Separation Method

- Operates at room temperature
- Simple system
- High separation ability (H/D 2～30)



Stage of Technology

- Basic research
- Applied research
- Practical development
- Production
- Commercialization

Fields of use

・Industrial gases (semiconductors, etc.)
・Pharmaceutical development

Information of intellectual property

Pub. No. US2022/0288532
Pub. No. CA3151601

Technical details

Contact information for inquiries Japan Atomic Energy Agency
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High performance, simple, low cost and environmentally friendly rare metal recovery

No.8

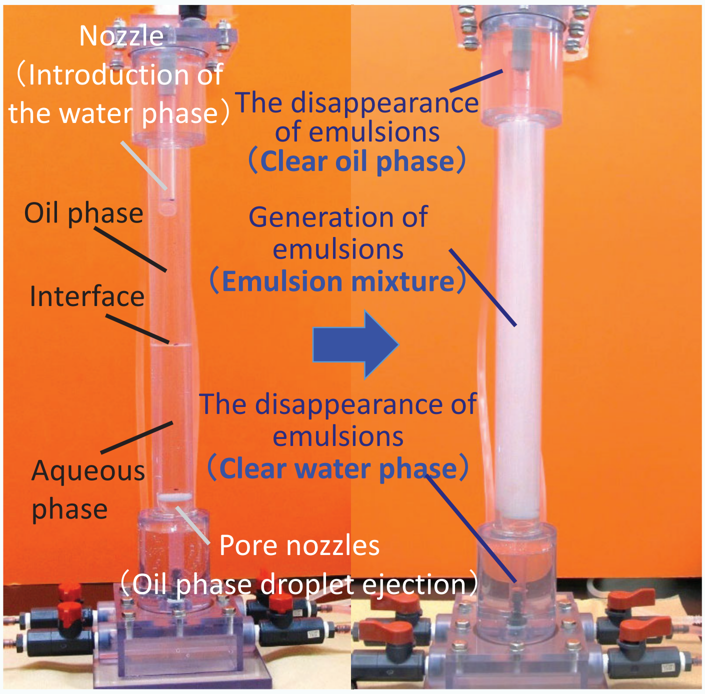
A new method of solvent extraction and wastewater purification for rare metals (emulsion flow)

- Processing cost: less than 1/5 of the conventional solvent extraction method (mixer-settler)
- Processing speed: more than 10 times faster than conventional methods (less than 1/10th the size of the equipment)
- Removes oil and suspended components (fine particles and other solids) from wastewater

Keywords： Emulsion flow, Solvent extraction, Rare metals, Recycling, Wastewater purification

Emulsion Flow Method

The emulsion flow method collects and removes both components dissolved in water and components suspended in water by spewing immiscible solvent into water.



The generation and dissipation of emulsions are fully controlled by pumping alone for ideal solvent extraction.

Evolved Equipment

Effective in purifying oil-contaminated water and removing suspended solids from wastewater

Stage of Technology

- Basic research
- Applied research
- Practical development
- Productization
- **Commercialization**

Fields of use

Recovery and recycling of rare metals, purification of industrial wastewater and oil contaminated water, and metal smelting

Information of intellectual property

Patent No. US9108124
Pub. No. US2022/0016582

Technical details

Contact information for inquiries Japan Atomic Energy Agency
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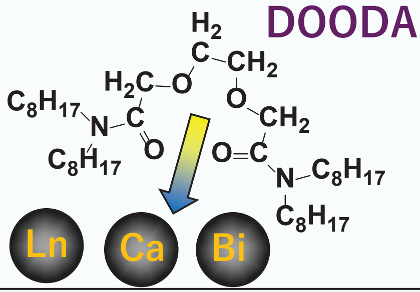
Separation and recovery of precious and rare metals

No.9

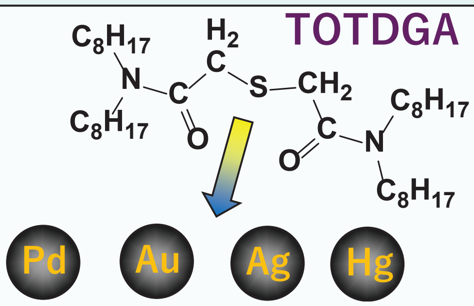
Rare metal extractant with excellent selectivity and extractability

- Dissolves well in all organic solvents
- Efficient recovery of Pb, Ag, Au, and Hg
- Easy organic synthesis

Keywords：Rare metals, Extraction separation, Hydrochloric acid solution, Extractant, Precious metals

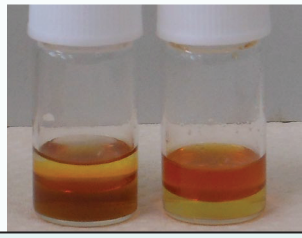


The oxygen (O) atoms in DOODA react easily with lithophile elements, such as rare earth elements, Ca, and Bi, and they can be recovered.

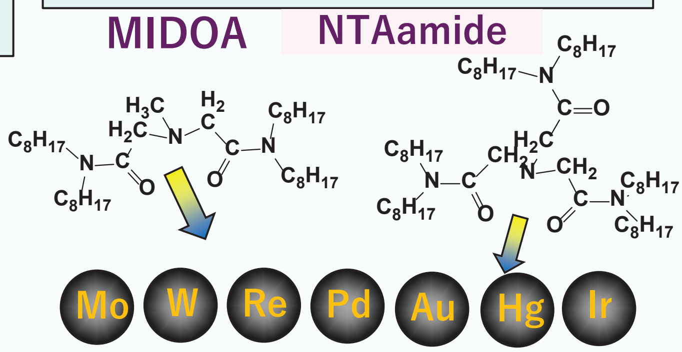


The sulfur (S) atoms in TOTDGA are limited to metals (Pd, Ag, Au, and Hg) that are more reactive than nitrogen. Therefore, there is no need to consider mutual separation after recovery.

Before extraction　　After extraction



Pd was extracted from 20 mM Pd/1M nitric acid to the organic phase (upper phase) using MIDOA.



The nitrogen (N) elements in MIDOA and NTAamide react easily with Mo, Re, Pd, Au, and Hg, and can be used for the recovery of a variety of metals.

Stage of Technology

- Basic research
- Applied research
- **Practical development**
- Productization
- Commercialization

Fields of use

・Recovery and reuse of rare metals and precious metals
・Use of new extractant

Information of intellectual property

Patent No. FR2970251

Technical details

Contact information for inquiries　Japan Atomic Energy Agency
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Strong and unbreakable at over 600 °C

No.10

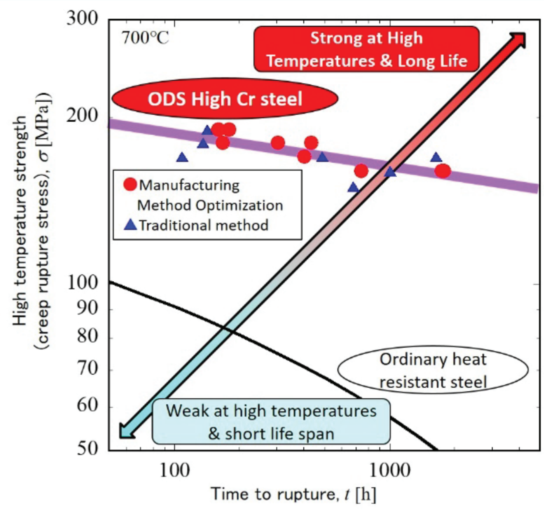
Oxide dispersion strengthened (ODS) high Cr steel

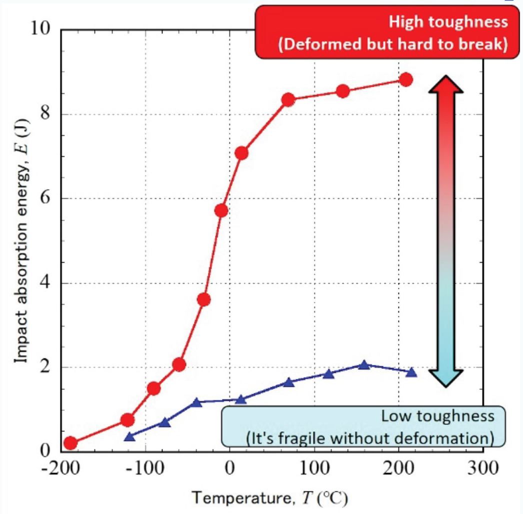
- Excellent corrosion resistance, high temperature strength, and toughness at over 600 °C
- Oxidation resistance comparable to that of stainless steel
- Good toughness at room temperature

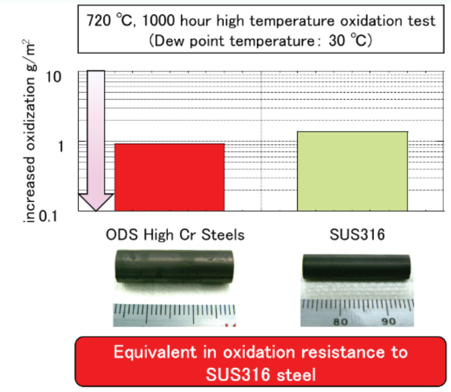
Keywords：Over 600 °C, Corrosion resistance, High temperature strength, Toughness, ODS

Heat resistant steel with high temperature strength, toughness, and corrosion resistance

・ Typical chemical composition (wt%)：Fe-0.13C-11Cr-0.4Ni-1.4W-0.2Ti-0.35Y_2O_3







The ODS high-Cr steel produced by this technology has excellent corrosion resistance, high-temperature strength, and toughness, all of which have been challenging to achieve with conventional heat-resistant steels.
The high corrosion resistance, high strength, and high toughness steel were achieved by not only the dispersion of oxides, but also the adjustment of composition (high Cr content), including Cr, which contributes to corrosion resistance, and the optimization of manufacturing process.

Stage of Technology

- Basic research
- Applied research
- **Practical development**
- Productization
- Commercialization

Fields of use

・Fusion reactor materials and thermal power generation materials
・Other high-temperature parts

Information of intellectual property

Patent No. FR1455408

Technical details

Contact information for inquiries　Japan Atomic Energy Agency
seika.riyou@jaea.go.jp

Suppression of stress corrosion cracking by process modification of conventional steel

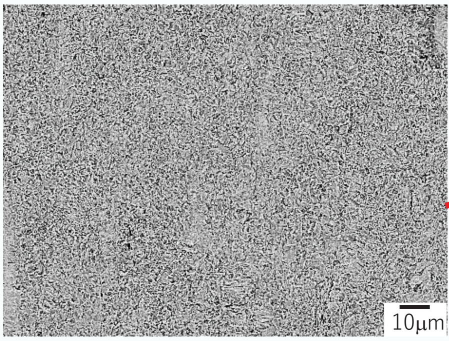
No.11

Development of stainless steel with balanced strength and ductility and brittle fracture resistance

- Inhibits embrittlement because of changes in dissolved oxygen concentrations
- Only to reduce the grain size of general-purpose stainless steel to fine grain
- Superior strength and ductility balance over conventional stainless steel

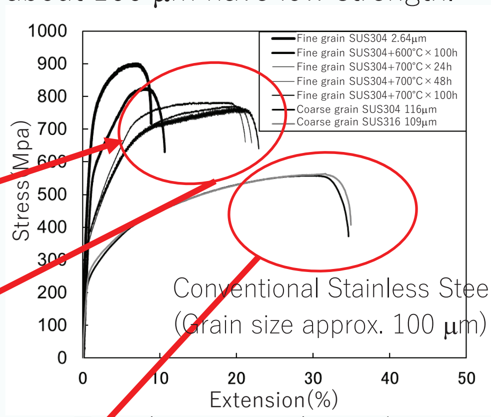
Keywords：Stress corrosion cracking, Fine grain, Dissolved oxygen, Brittle fracture rate

The present invention achieves a grain size of 2.67 μm with a material that is maintained at 600 °C to 700 °C for 100 h after being strongly worked on stainless steel.

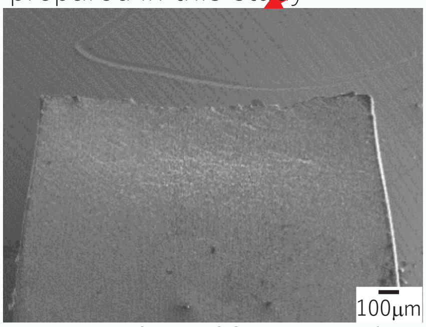


Microstructure of the material prepared in this study

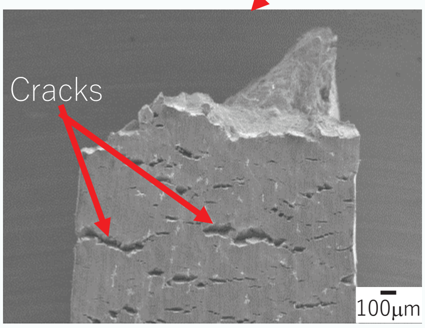
This fine-grained stainless steel have an excellent strength-ductility balance, whereas conventional stainless steel with a grain size of about 100 μm have low strength.



Tensile test results under pressurized water reactor conditions



Fracture surface of fine-grained stainless steel after 700 °C for 100 h.



Fracture surface of conventional stainless steel (Grain size 116 μm) after testing.

The brittle fracture rate of the fine-grained stainless steel was 5%. However, conventional stainless steel had a brittle fracture rate of 24% because of cracking.

⇩

Fine-grained stainless steel had excellent resistance to stress corrosion cracking.

Stage of Technology

- Basic research
- Applied research
- Practical development
- Productization
- Commercialization

Fields of use

・Materials for LWRs
・Automotive and portable electronic device chassis

Information of intellectual property

Patent No. US11597982

Technical details

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High radiation resistance and beautiful image quality

No.12

Radiation resistant digital camera system

- Proprietary photodetectors and signal-processing functions
- Functioning in a high radiation environment that is inaccessible to humans
- Autonomously optimizes image quality for high sensitivity, high resolution, and high image quality

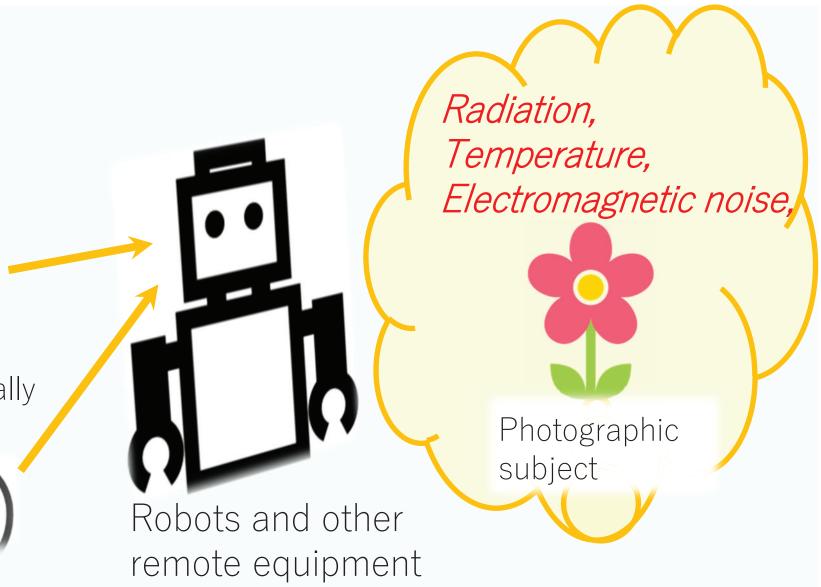
Keywords : Digital camera, Radiation resistance, Photodetector, Robotics, Electromagnetic noise, Radiation sterilization

Photodetector

Performs the function of the eye, combining high radiation resistance with high sensitivity and high resolution

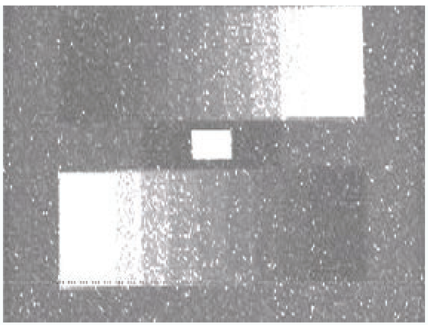
Signal processing function

Functions as a brain that automatically detects image degradation and self-corrects

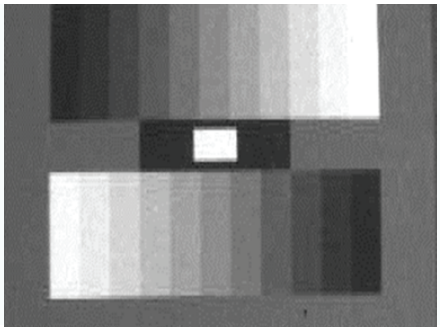


Example of Image Quality Improvement for Camera Image Degradation under Radiation Environment

Monitor image of a normal camera



Monitor image of this camera system



Stage of Technology

- Basic research
- Applied research
- **Practical development**
- Productization
- Commercialization

Fields of use

Radiation sterilization monitoring in the manufacturing, medical, and aerospace fields.

Information of intellectual property

Patent No. US10652488
(Co-applicant: Brookman Technology, Inc., Ikegami Electronics, Inc.)

Technical details

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Accurate measurement of flow rates in various channels

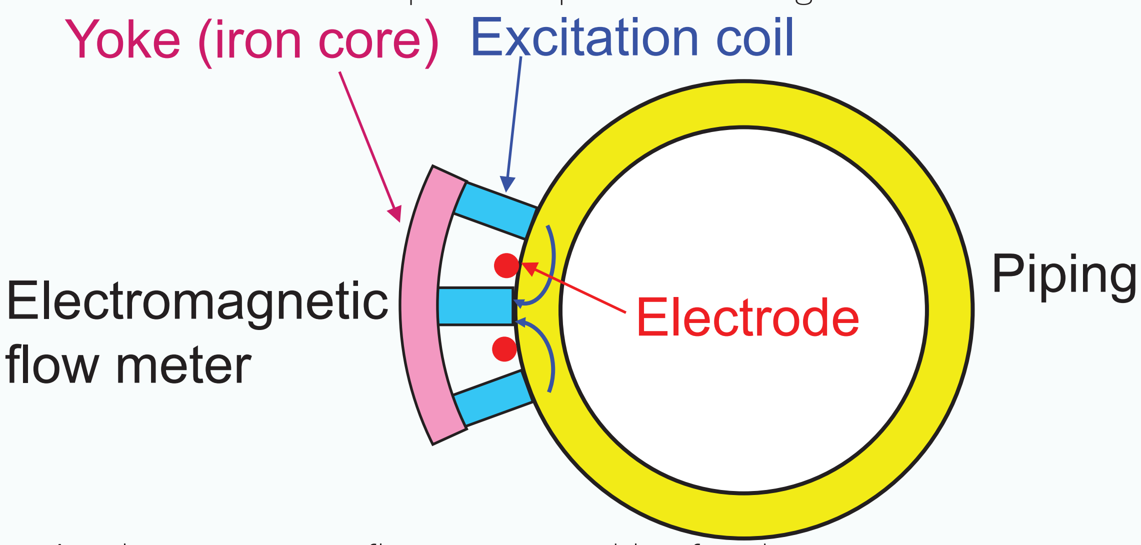
No.13

Compact electromagnetic flowmeter

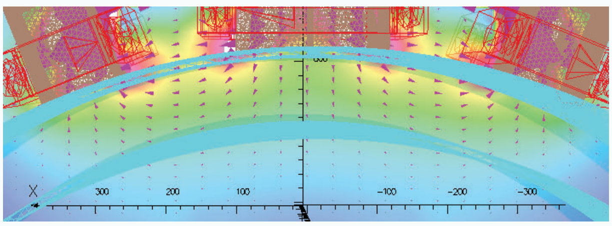
- Applicable to annular channels
- Significantly reduced space requirements for flowmeter placement

Keywords：Electromagnetic flowmeter, Liquid metal, Conductive fluid, Electrolyte

The concept of compact electromagnetic flowmeter



・An electromagnetic flowmeter capable of making accurate measurements in the annular flow channel of an electromagnetic pump was investigated.
・Compared to the conventional type, it is more compact and therefore more effective for ordinary piping.
・Magnetic field analysis confirmed the effectiveness of this method (The figure below).



Stage of Technology

- Basic research
- Applied research
- Practical development
- Productization
- Commercialization

Fields of use

・Flowmeter for conductive fluids such as liquid metal

Information of intellectual property

Patent No. FR0601973

Technical details

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Carbon-14 dating on the tabletop ultra-small accelerator mass spectrometer

No.14

Miniaturization of an accelerator mass spectrometer with a functional ion beam transmission membrane

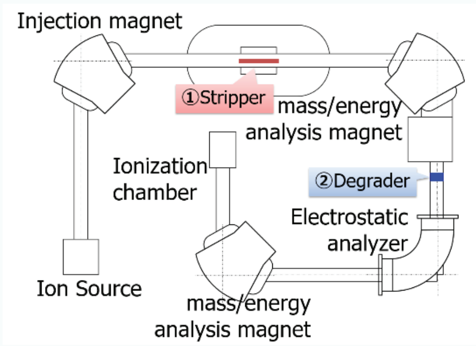
- Separation of interfering particles with a permeable membrane using ion channeling
- Enables dramatic downsizing of accelerator mass spectrometer (AMS)
- No gas stripper is needed and the efficiency of separation of similar heavy atoms is significantly improved.

Keywords： Accelerator mass spectrometer (AMS), Stripper, Degrader, Dating

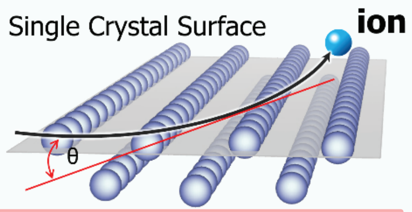
The newly developed ion beam functional permeation membrane is used as a filtering system in AMS.

① For separation of isobaric molecules
Channeling stripper

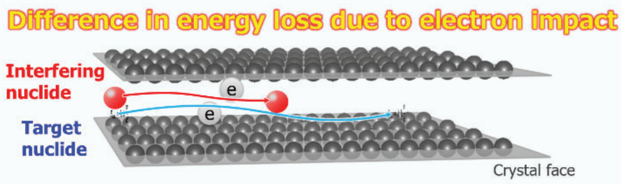
② For separation of isobaric atoms
Channeling degrader



Schematic diagram of AMS equipment



Channeling stripper



Channeling degrader

Task (Common principle)	Conventional technology	This technology
① Fractionation of isobaric molecules (Dissociation by electron impact)	Name: Gas stripper Method: Passing through the gas Problem: Gas diffusion	Name: Channeling stripper Method: Specular reflection on the crystal surface Effect: No gas required
② Fractionation of isobaric atoms (Atomic number dependence of stopping power)	Name: Degrader Method: Passing through an amorphous film Problem: Low transmittance	Name: Channeling degrader Method: Channeling with single-crystal films Effect: High transmittance

Stage of Technology

- Basic research
- Applied research
- Practical development
- Productization
- Commercialization

Fields of use

・Accelerator mass spectrometry (AMS)
・Ion beam

Information of intellectual property

Patent No.US11051390
(Co-applicant: PESCO Co., Ltd.)
A.Matsubara, N.Fujita, and K.Isii, Nucl.Instrum.Methods, B437, 81 (2018)

Technical details

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Uranyl ions can be analyzed with high sensitivity

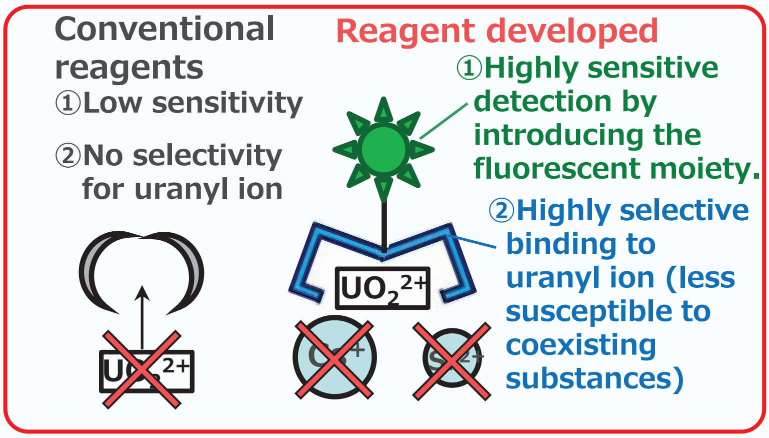
No.15

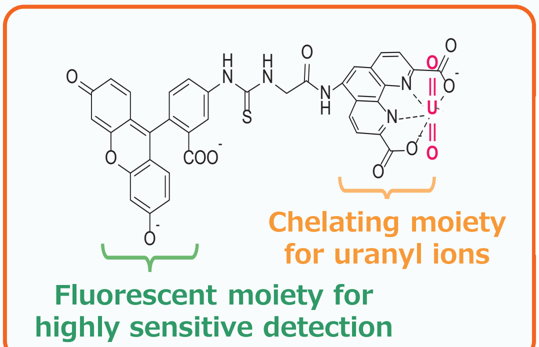
Highly sensitive and rapid analytical method for uranyl ions

- A new reagent for highly sensitive detection of uranyl ions
- High sensitivity using fluorescence detection
- High selectivity for uranyl ions

Keywords : Uranyl ions, Environmental samples, Radioactive samples, Capillary electrophoresis, Fluorescence detection, Analytical reagents

- Highly sensitive detection of more than 100,000 times higher sensitivity than conventional reagents by introducing the fluorescent region.
- The chemical structure that selectively bind to uranyl ions enables analysis that is not disturbed by coexisting substances.





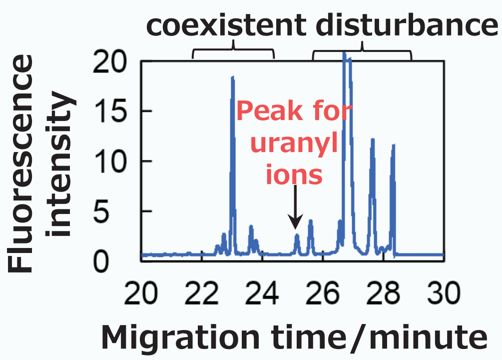
Analytical reagent for uranyl ions

(1) Safety (high sensitivity)

10 mL → 0.05 mL   1 L → 0.01 L

Reduction of liquid wastes generated from analysis to lower than 1/100th

(2) Short analysis time



Stage of Technology

- Basic research
- Applied research
- **Practical development**
- Productization
- Commercialization

Fields of use

- Analysis of uranyl ions in environmental samples
- Analysis of uranyl ions in radioactive samples
- Environmental field and nuclear energy field

Information of intellectual property

Patent No. US9110047

Technical details

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Environmental purification using food bone waste

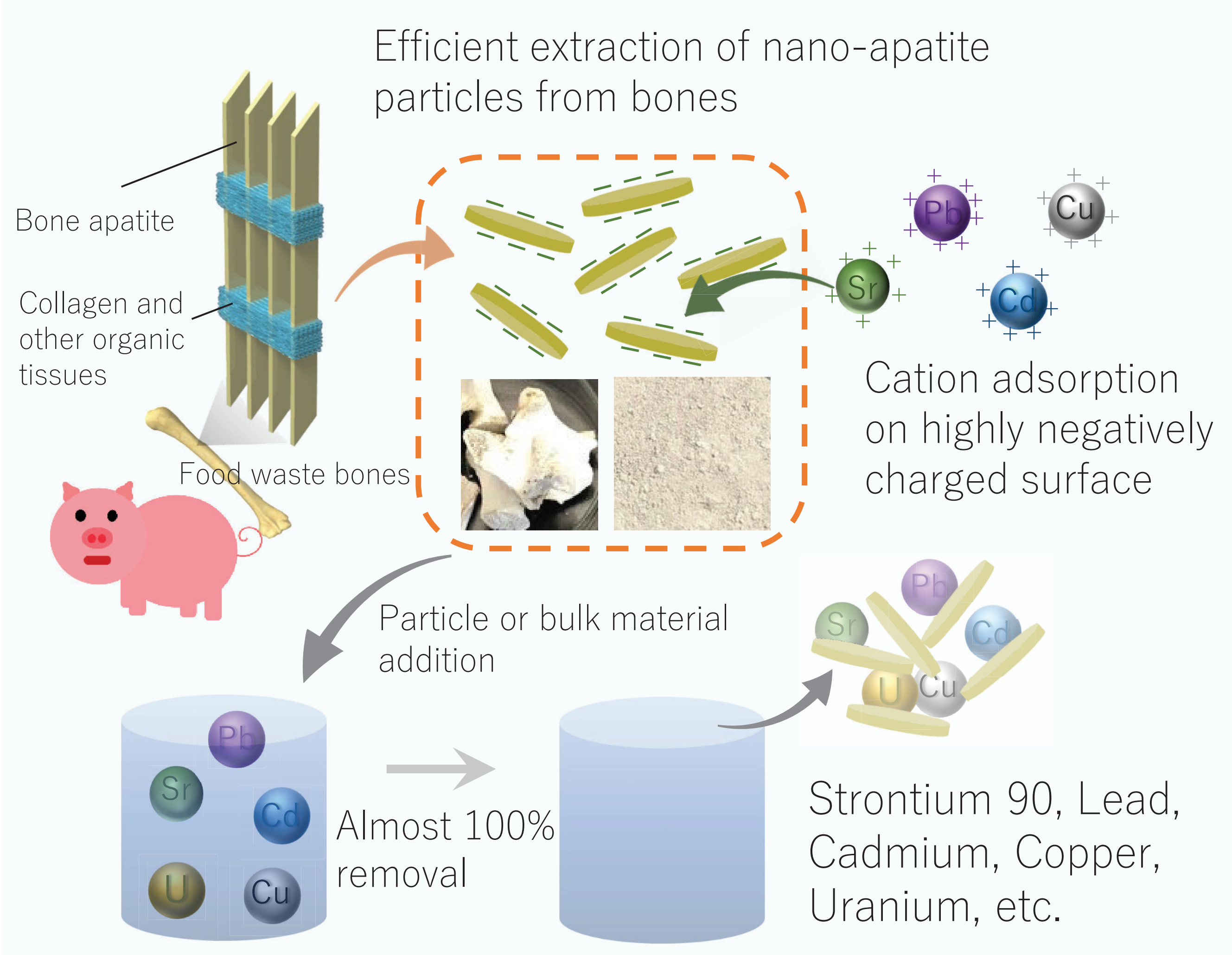
Low-cost adsorbent that can remove toxic metals with high efficiency

No.16

Carbonate apatite with high carbonate group content

- Low-cost, high-efficiency removal of strontium 90, cadmium, lead, copper, etc.
- High-performance adsorbent made from food waste material
- Simultaneous remediation of environmental pollution and food waste problems

Keywords： Toxic metal ions, environmental purification, contaminated water, sustainable society



Stage of Technology

- Basic research
- **Applied research**
- Practical development
- Productization
- Commercialization

Fields of use

- Decontamination of the environment
- Recovery and recycling of rare metals
- Nuclear power, Environment, civil engineering, construction

Information of intellectual property

Patent No. US11577216
Patent No. US11649166

Technical details

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Heavy charged particles can be measured with low gamma-ray contamination

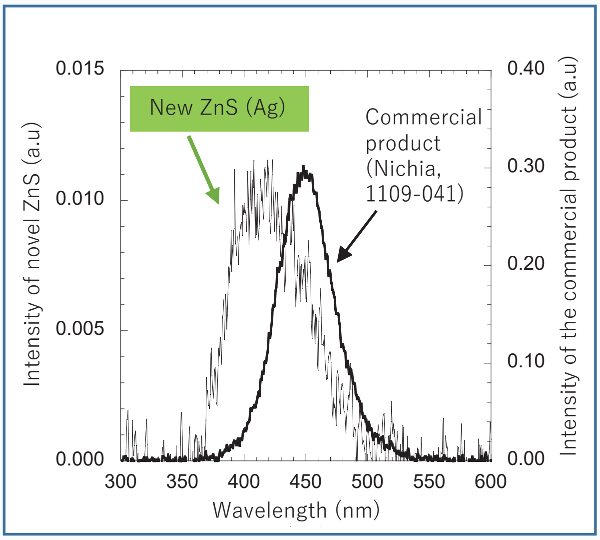
Novel ZnS(Ag) phosphor material with low gamma-ray sensitivity and afterglow

- Detection of heavy charged particles with high signal to noise ratio under high gamma-ray environment
- High count rate capability compared with conventional products
- Applicable in neutron detection with converter materials

Keywords: ZnS phosphor, Heavy charged particle, Low gamma-ray sensitivity, Low afterglow

- Measurement of heavy charged particles with low gamma-ray contamination thanks to decreased light emission post gamma-ray irradiation.
- High count rate capability owing to the decreased afterglow.

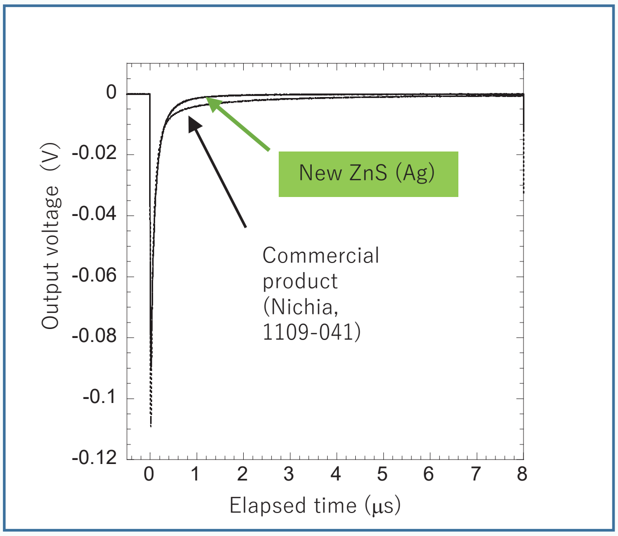
Emission light spectra under illumination with gamma-rays (^{60}Co)



- Emission intensity with gamma-ray (electrons) irradiation decreases by ~1/20 compared with the commercial product

→ Low gamma-ray background

Scintillation signal under illumination of alpha particles (^{241}Am)



- Light decay time decreases by ~1/5 of the commercial product

→ Improved count rate capability

Stage of Technology

- Basic research
- **Applied research**
- Practical development
- Productization
- Commercialization

Fields of use

- Radiation monitoring at nuclear fuel facilities, etc.
- Heavy charged particles/neutron measurement at advanced experimental nuclear facilities

Information of intellectual property

Patent No. US9884989

Technical details

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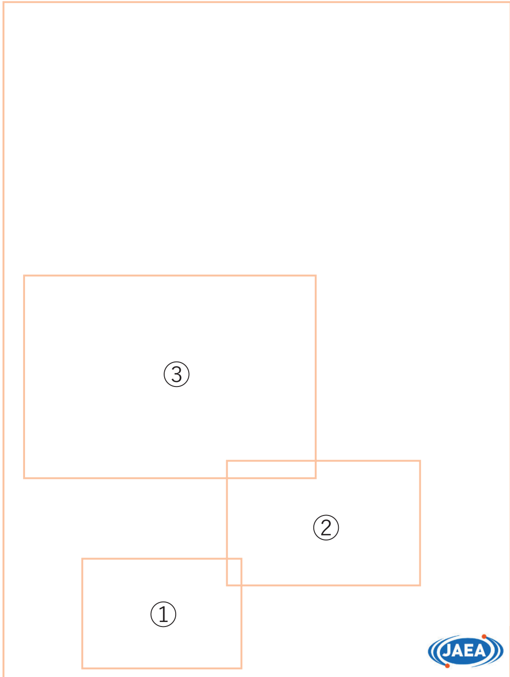

＜Back cover photo＞

This is a robot for radiation observation jointly developed by the JAEA and SHIMANO Inc. (Sabae City, Fukui Prefecture) and a demonstration example. The robot acquires information on the three-dimensional (3D) distribution of radioactive contamination in a radiation environment, such as a decommissioning site of a nuclear facility.

① Robot for radiation observation taking pictures, wearing a special raincoat to for waterproofing and preventing contamination.

② Example of the demonstration at Fugen, 3D model using a LiDAR camera.

③ Example of the demonstration at Fugen, visualization of the high-dose-rate spot in ②.

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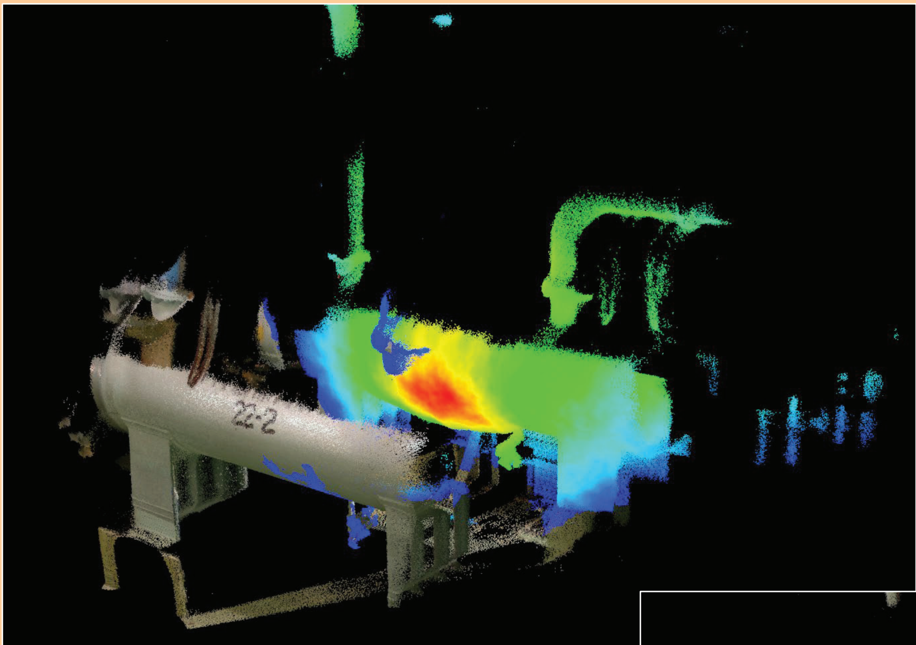
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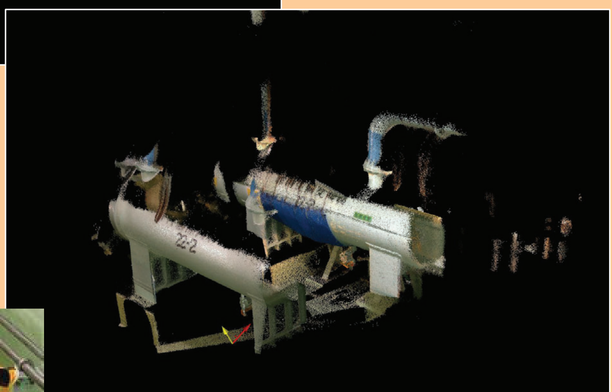
22-2