SUMITOMO ELECTRIC
Connect with Innovation

# R&D

## Research & Development

Each company of the “Sumitomo Electric Group” combines its unsurpassed creativity with knowledge and experience to generate ideas that allows the group to contribute to society.

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Information Network R&D Center, IoT R&D Center,
Analysis Technology Research Center,
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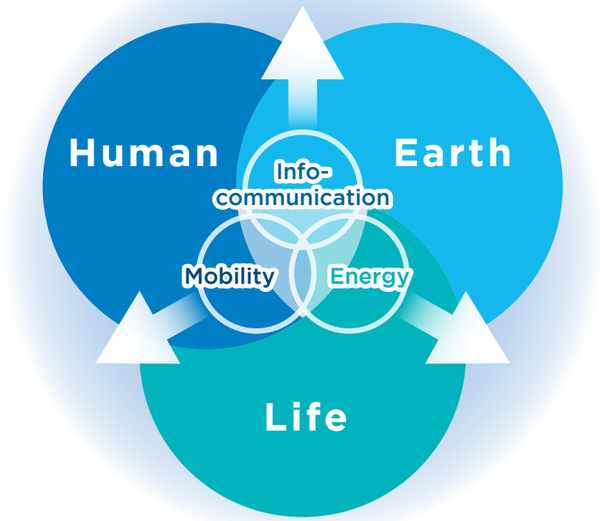
May 2023


SUMITOMO ELECTRIC GROUP

# R&D Long-Team Vision and Organization

## Fundamental Approach

To achieve the Group's management principle of "Pursuing top technologies, evolving technologies that 'connect and support', and generating innovation through the Group's combined strengths", it's important that we (1) further strengthen our technologies in the business domains in which we operate and (2) create new products and services in new business domains.




## Strengthen technologies in current business domains

We are increasing innovation in materials and device technologies that support the advancement existing business domains.
1) Energy Domain: cable technology that contributes to the strengthening of power grids and energy management technology that is essential for the utilization of renewable energy
2) InfoCommunication/Electronics Domains: technologies that achieves high speed and large capacity while realizing small size and low power consumption
3) Mobility/High Performance Products Domains: technologies for CASE (Connected Automated Shared Electrified Vehicle).

## Create new products and services in new business domains

We are exploring next-generation research and development themes. By backcasting from the social issues of 2030 and beyond, we have defined three technology fields to focus on: "Earth", "People", and "Life". In “Earth” related fields, we will promote technological development related to GX (Green Transformation) for the realization of a sustainable society. In “Human” related fields, we will focus on the technologies necessary for individuals to maximize their abilities. Finally, In “Life” related fields, including in the virtual space, we will focus on technologies that connect person-to-person and person-to-things.
We will extend our strengths fundamental technologies such as materials and devices to support the above three fields.



## Three pillars of our strategy

To revitalize and speed up research and development to create diverse technologies, we are strengthening our efforts under three strategic pillars.

**Needs-Driven**

**Driven by the demands of society**

Exploring themes derived from backcasting of an ideal society challenges of 2050.

**Speedy**

**Acceleration of the R&D process**

Actively introduce materials informatics(MI), process informatics(PI), etc, thereby accelerating the development of materials and processing technologies, on which we pride ourselves, and enhance process efficiency in the from of automation, remote operation, etc.

**International**

**Collaboration with overseas partners**

- Global cooperation of SEG to share technology, know-how, ideas, etc
- Alliance with overseas companies, academic institutions, etc

## R&D Organization

R&D Unit

- Power Systems R&D Center
- Information Network R&D Center
- IoT R&D Center
- Analysis Technology Research Center
- Advanced Materials Laboratory
- Energy and Electronics Materials Laboratory
- Optical Communications Laboratory
- Transmission Devices Laboratory
- Cyber-security R&D Office
- FEX Development Office
- Frontier Technologies Laboratory
- R&D Planning & Administration Division

- Innovation Core SEI, Inc. (ICS)
- SEI Automotive Europe GmbH Innovation Core Department (ICS-Euro)

# Power Systems R&D Center

The electric power infrastructure sector is implementing technological innovations such as increased use of renewable energy and upgrading of power infrastructure using information and communication technologies. The Power Systems R&D Center works on development of new technologies and products tailored to those technological innovations. Examples include constituent technologies, products, equipment and systems essential for smart grids, i.e. future power networks.

## Redox flow battery

For power grids that use renewable energy-based power generation, the role of storage batteries is vitally important, charging and discharging power in response to fluctuations in the amount of generated power. The redox flow battery is suitable for irregular, highly fluctuating charge-discharge operation. Moreover, the amount of power stored in it can be accurately monitored and controlled. Therefore, it is an ideal storage battery for smart grids designed for efficient use of renewable energy sources such as solar and wind. The redox flow battery is considered a key device toward achieving carbon neutrality. While we have placed redox flow batteries on the market, we are working on further product development with the aim of putting them into full practical use.


## High-temperature superconductor wire

Development of a low-cost, rare-earth-based, high-temperature superconductor is under way using Sumitomo Electric's proprietary chemical solution deposition method. This superconductor is 200 times superior to copper wires in current carrying capacity at –196°C using liquid nitrogen.

Moreover, Sumitomo Electric has developed the world's first stable superconducting joining technology and created a coil that can produce a magnetic field with permanent currents. These technologies are expected to enable high-temperature superconductors to be deployed in nuclear magnetic resonance (NMR) devices and magnetic resonance imaging (MRI) devices.

In addition, use of the high-temperature superconductor is anticipated in magnets for small fusion reactors and superconductor motors.

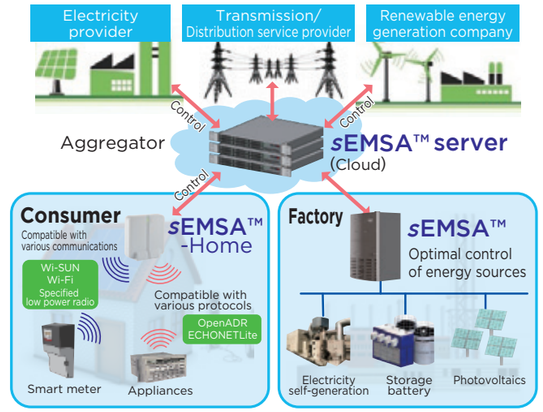


## Power control system

A power conditioner is a power converter used to ensure optimum control of solar power and other renewable energy systems and storage batteries for grid-connected or isolated operation. We are developing power conditioners using power electronics technology. We are also working on development of distributed power systems for household and industrial use, combining the power conditioner with solar panels and storage batteries.

## New energy system

Our new energy system architecture (sEMSA™) optimally controls distributed power sources such as widespread photovoltaic generation, cogeneration and storage batteries, maximizing captive consumption of renewable energy and reducing electricity cost. Furthermore, using sEMSA™ it is possible to build a virtual power plant (VPP) system for aggregators, linking consumers' energy sources for centralized control and providing coordination capability for power grid stabilization.

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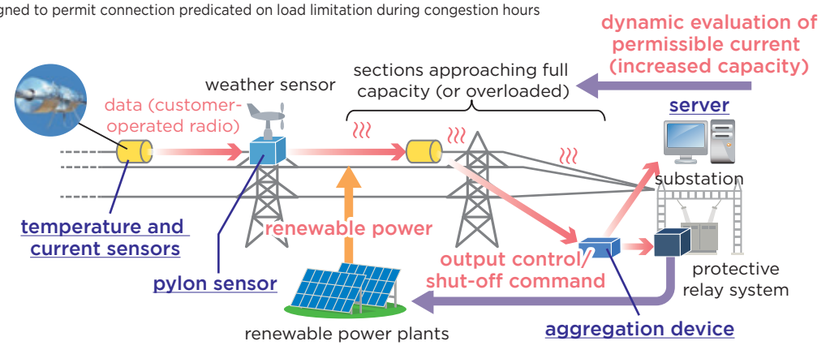
* ECHONET and ECHONET Lite are trademarks or registered trademarks of the ECHONET Consortium.

## Overhead power transmission line monitoring system

The sharp increase in use of renewable energy sources has resulted in the problem of difficulty in connecting additional renewable power plants due to power grid congestion. Our overhead power transmission line monitoring system directly measures the temperature of and current carried by transmission lines by utilizing sensors, sends the data by customer-operated communication equipment (radio or OPGW) or LTE, and assesses dynamic line condition to obtain a higher permissible current level than previously possible (dynamic line rating). Moreover, we have developed a system that, in conjunction with a protective relay system and a non-firm connection* system, helps introduce a large amount of renewable energy.

*A system designed to permit connection predicated on load limitation during congestion hours



# Information Network R&D Center

We conduct R&D in optical network systems and wireless communications for fifth-generation (5G) and beyond 5G (6G) mobile communications systems which support high-speed broadband communications. In the field of mobility systems, we develop millimeter-wave radar employing our wireless technology, traffic signal control systems using probe vehicle information, and vehicle routing and scheduling systems for MaaS (Mobility as a Service), and other solutions.

## Optical network systems

Broadband demand is growing from year to year with the emergence of new information services such as IoT, 5G wireless and autonomous driving. To support such social developments, we are conducting R&D encompassing 10G-EPON systems and their optical components that enable FTTH (fiber to the home) services and provide communication 10 times faster than current services, as well as Ethernet access devices and all optics network devices that make possible low-delay and high-reliability services.

Optical transceiver

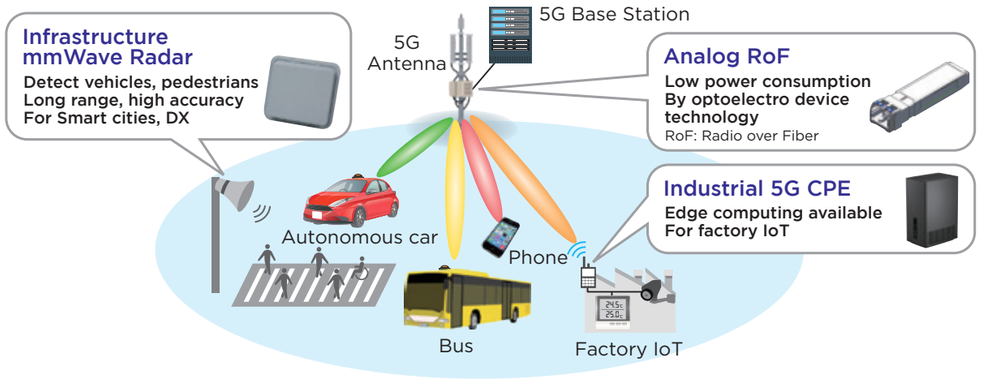
10G-EPON Optical Line Unit

Ethernet access devices for business

5G wireless fronthaul/ All Photonics Network devices

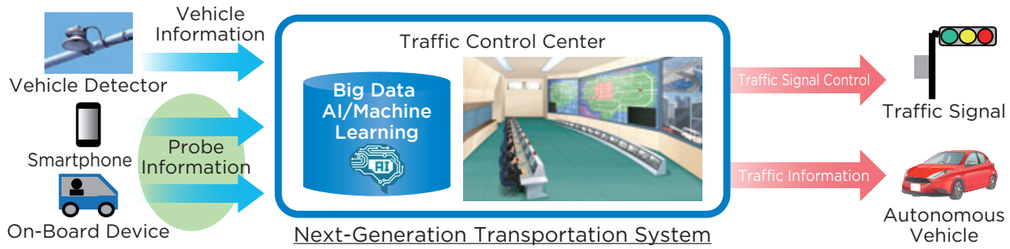
## Wireless systems

The IoT and DX markets are growing rapidly with the use of 5G, which features enhanced Mobile Broadband (eMBB), Ultra Reliable Low Latency Communications (URLLC), and Massive Machine Type Communications (mMTC) and utilization of sensors that can detect objects such as people and vehicles with high accuracy.
We survey market needs, and then develop wireless devices and optical / wireless modules for 5G, Beyond 5G, and transport infrastructure applications based on our radio / antenna technology, optoelectronic technology, and signal and data-processing technology.

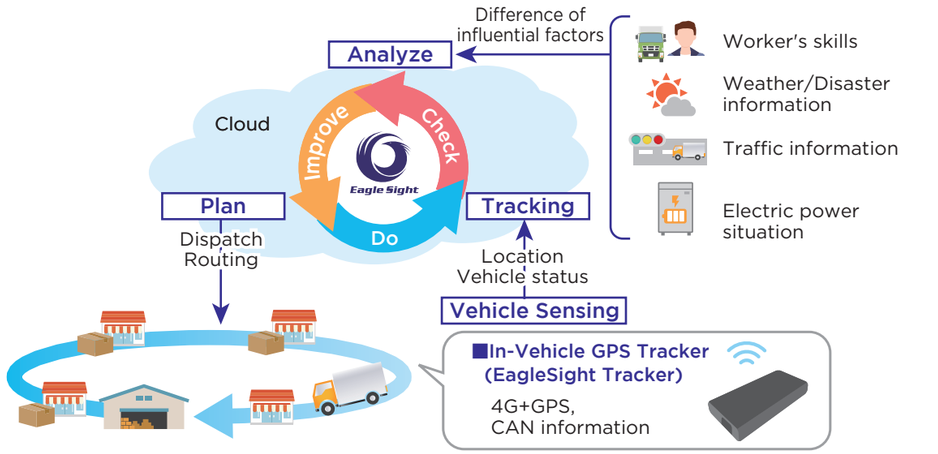



## Mobility system

We are developing advanced traffic systems and vehicle routing and scheduling systems for MaaS to realize a society with a safe and secure, eco-friendly transportation system.
Using AI for the processing of probe data such as vehicle position and speed, we are developing advanced signal control systems. We are also working on the development of vehicle routing and scheduling systems for MaaS leveraging our expertise in real-time vehicle management and delivery planning.
Moreover, we are working on research and development of systems that securely store a wide variety of data (big data) received from vehicles in the cloud, and that makes use of that data.



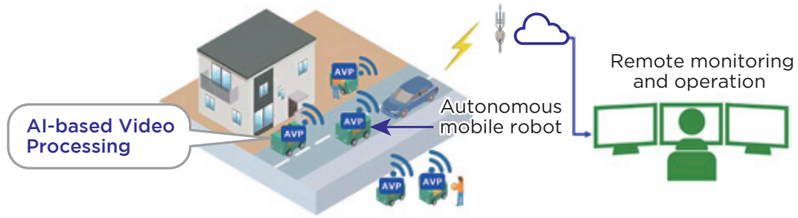

Next-Generation Transportation System




Intelligent Mobility Management System

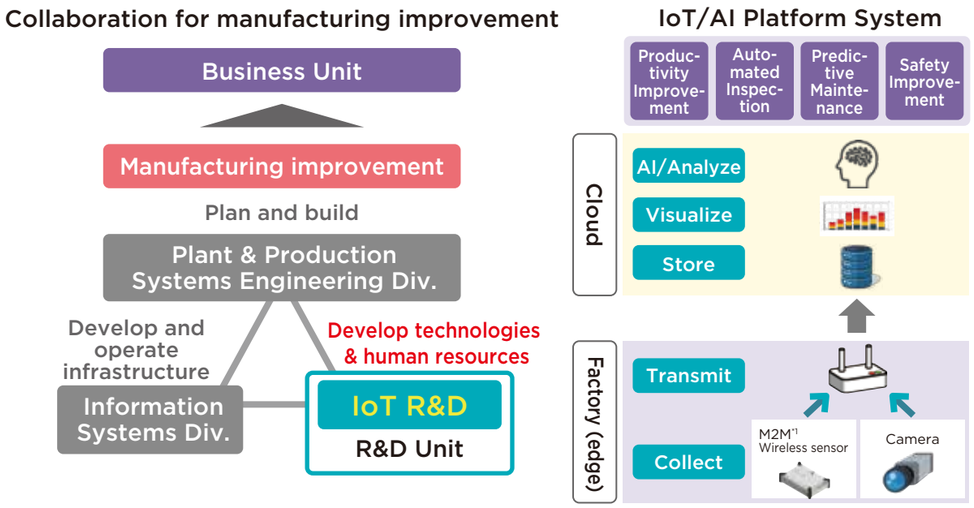
## AI-based Video Processing

As cameras adopted higher resolutions, such as 4K and 8K, the increase in data volume in the storage and transmission of video data has been a problem. We are developing AVP (AI-based Video Processing) technology, which can achieve a compression ratio 10 times higher than conventional systems.



# IoT R&D Center

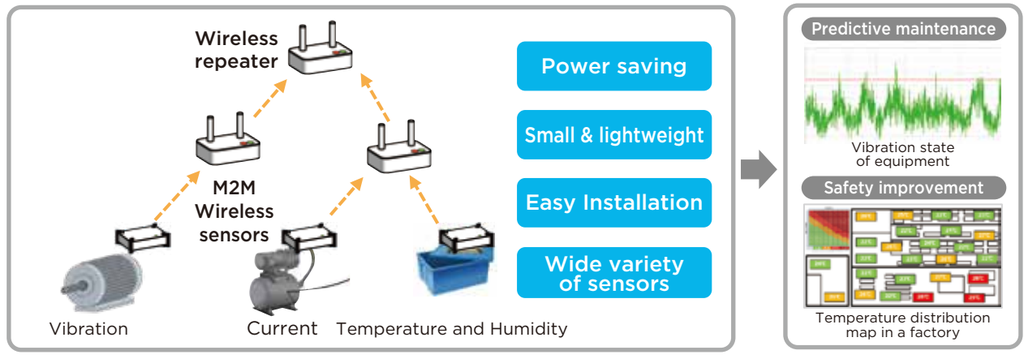
In collaboration with manufacturing sites within the Sumitomo Electric Group, we promote manufacturing improvements using IoT(Internet of Things)/AI technologies such as various sensing methods, wireless communication and AI data analysis to deal with major production challenges: productivity improvement, automated inspection, predictive maintenance, and safety improvement.
Our center works closely with the Plant & Production Systems Engineering Division and the Information Systems Division to develop IoT/AI-based systems and train human resources.




*1 M2M(Machine to Machine): direct communication between devices

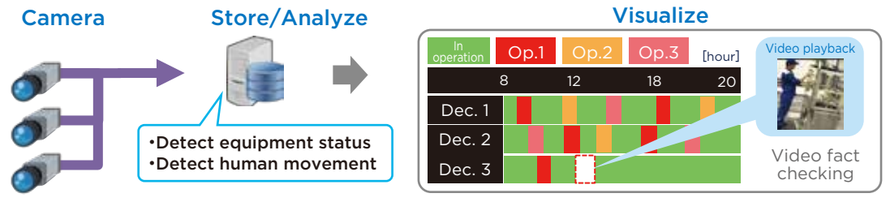
## M2M Wireless Sensor

We develop battery-driven M2M wireless sensor to collect equipment data easily. The collected data is visualized by the IoT/AI platform system and can be used for various manufacturing improvements.




## Visual Analyzer

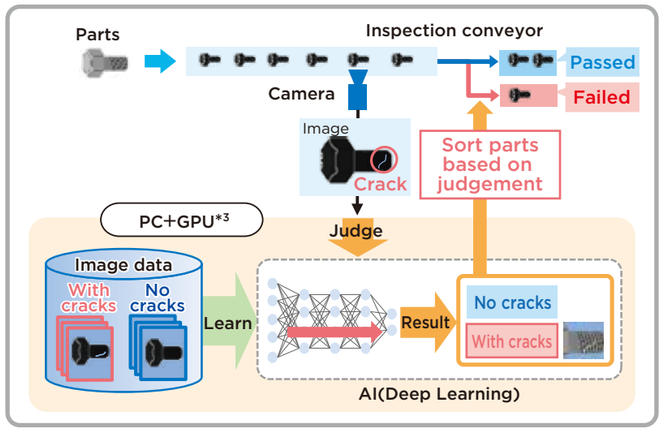
There are two fundamental challenges in data collections on a factory floor. One is that old equipment often requires expensive modification. The other is the difficulty in collecting data regarding how workers move and operate on a factory floor. Visual Analyzer uses AI video analysis technology to extract and visualize operation information and stopping factors from camera images. For example, Visual Analyzer can automate the time measurement of setup work, detect excess work time and variation, and look back at those images to check the cause.



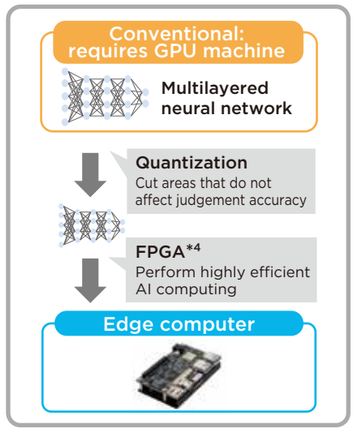

## Automated AI Inspection

In many inspection processes, securing and developing human resources that perform visual inspection has been emerging as an issue. For that reason, we are working on automation of inspection processes using AI technology (Deep Learning*2). In addition, we are developing edge computers to reduce the cost and size of automated inspection systems.

### Example of automated inspection



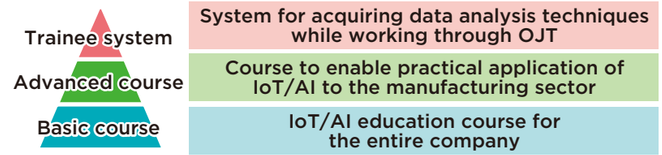

### Edge computer development




*2 Deep Learning:AI technology that performs learning by using a multilayered neural network which imitates the structure of the human brain
*3 GPU(Graphics Processing Unit):specialized processor designed for image processing *4 FPGA(Field Programmable Gate Array):rewritable logic circuit

## IoT/AI Human Resource Development

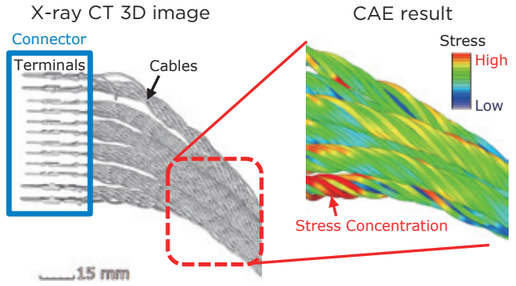
We have prepared a 3-step training course to develop human resources with IoT/AI knowledge company wide so that all business units in the Sumitomo Electric Group can proactively use IoT/AI technologies.



# Analysis Technology Research Center

We support the manufacturing and development of our group's products through advanced analysis and CAE (Computer Aided Engineering) technologies. Our main bases are in our Osaka, Itami and Yokohama works. We have bases in external facilities such as the Kyushu Synchrotron Light Research Center.

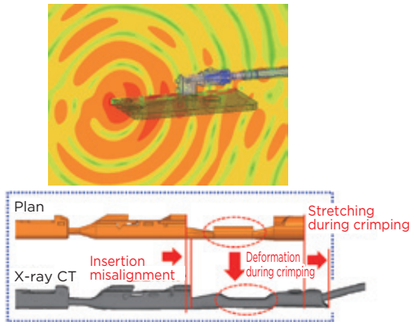
## Electric wire service life prediction



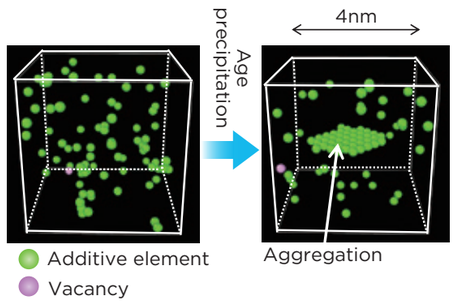

Automotive doors and robot arms incorporate electric wires and cables in moving parts. We are developing CAE technology for predicting the service life of these cable and wires by utilizing X-ray CT and AI techniques that can obtain their twisting and bending trajectories automatically.

## High frequency electromagnetic analysis for high-speed communication

We use high-frequency electromagnetic analysis to develop products that support high-speed communication technologies such as CASE and 5G. In order to capture electromagnetic waves with shorter wavelengths due to higher speeds, we make the most of large-scale computing servers, and we are also promoting collaboration with actual observation technology to take into account minute changes in shape during product processing.



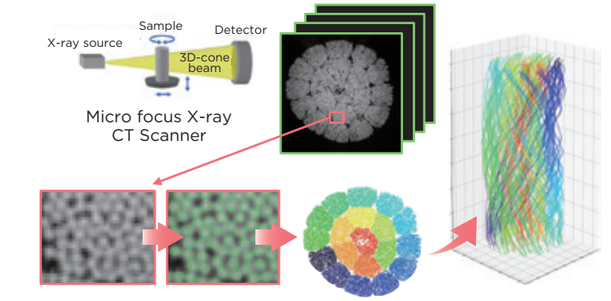

## Computational materials design for aluminum harnesses




When certain elements are added to aluminum wire, their atoms aggregate over time to increase the strength of the wire. We are developing a simulation technology that can visualize this aggregation behavior in order to select the additive elements and to determine the aggregation conditions.



## Quantification of three-dimensional structures with data analysis technology




CT images of Electric wire cable(173x19=3287cabels), and the quantification result of these image

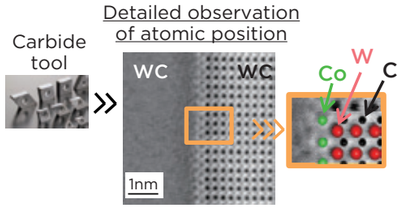
Trajectory data of each wire

We visualize the three-dimensional structure of the product. We quantify the structure with the latest data analysis technology. And, We visualize the three-dimensional structure of products and quantify it with the latest data analysis technology and use this to solve or improve upon product quality problems using DX technology.

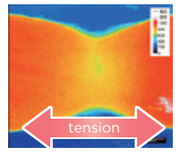
## Fine structure analysis with atomic-level resolution

We are developing technology using scanning transmission electron microscopes, focusing on crystal orientation analysis as well as conventional microstructural analysis. By using this technologies, we are developing high quality devices and materials.

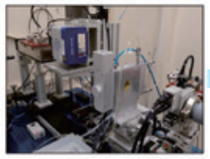
Scanning Transmission Electron Microscope (STEM)



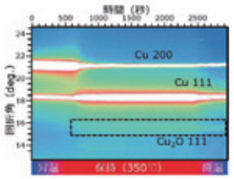

## Atomic level investigation using synchrotron radiation and first-principle calculations


Contour plot of thickness distribution just before fracture



In-situ analysis system using synchrotron radiation




Crystal structure analysis by in-situ XRD

We develop analysis technologies using synchrotron radiation, neutrons and other leading analysis technology in order to investigate material structures at the atomic level.
We utilize two beamlines of synchrotron radiation that are exclusive to Sumitomo Electric Group. Furthermore using simulation techniques such as first-principles calculations, we explore new materials through the mechanism that gives them their high performance characersitics.

# Advanced Materials Laboratory

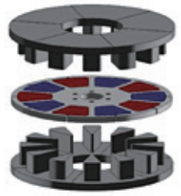
We create unique metallic and inorganic materials through process innovation using our original ultra-high pressure and powder metallurgy technologies, and computational science. We contribute to the expansion of our business in industrial materials and other business fields through the development of highly functional materials and parts including cemented carbide cutting tools, diamonds, ceramics, sintered ferrous alloy parts, and special steel wires.

## Powder metallurgy

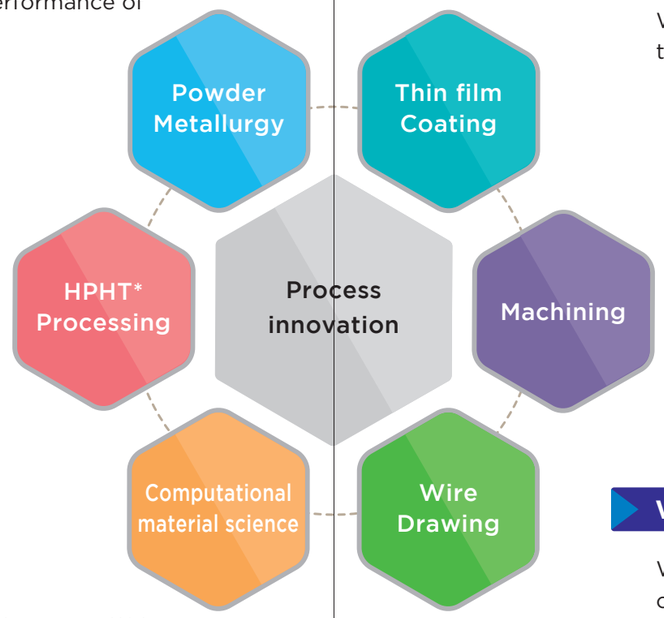
We have developed cemented carbide and cermet for cutting tools and sintered ferrous alloy and aluminum alloy parts for automobiles. We are now developing magnetic materials (soft magnetic composite) and related products which contribute to the higher performance of motors and sensors.

Soft magnetic composites

Cemented carbide materials



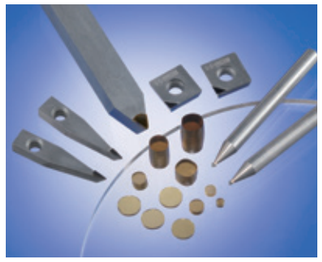
Axial flux motor modules



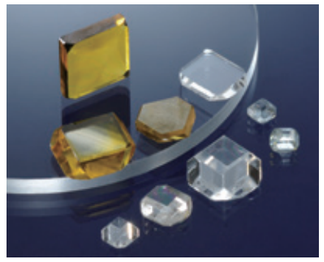

*HPHT : High pressure and high temperature

## Ultra-high pressure technologies

We have developed materials such as sintered diamond, nano-polycrystalline diamond and high-pressure synthetic diamond, and processes using our ultra-high pressure technology.
Recently, we have begun development of new diamond materials with improved mechanical strength and electrical properties.



Nano-polycrystalline diamonds

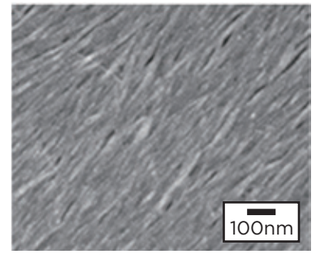


Synthetic single crystal diamonds

## Thin film coating technology

We are developing a coating technology to apply a ceramic film with high hardness and good adhesion on cutting tools. We are also developing nano filtration membrane for use in the environmental field.

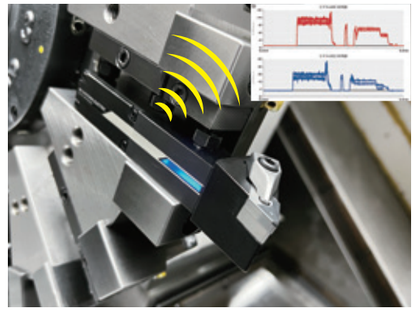
PVD coated inserts




Nano filtration membrane

## Machining technology

We are developing high value cutting tools by using machining monitoring techniques and advanced tool fabrication processes including 3D printing.

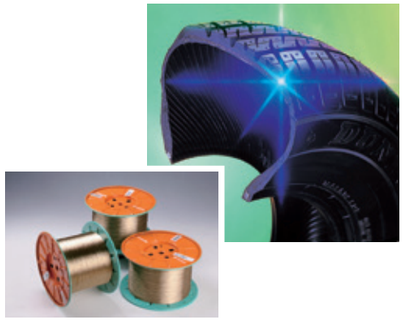


Sensing tools

## Wire drawing technology

We are developing high performance spring wires, high strength steel tire cords and high-strength conductive wire employing our drawing technology with heat treatment and electroplating.

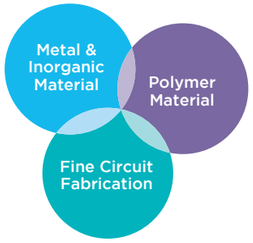
High-strength conductive wire



Steel tire cord

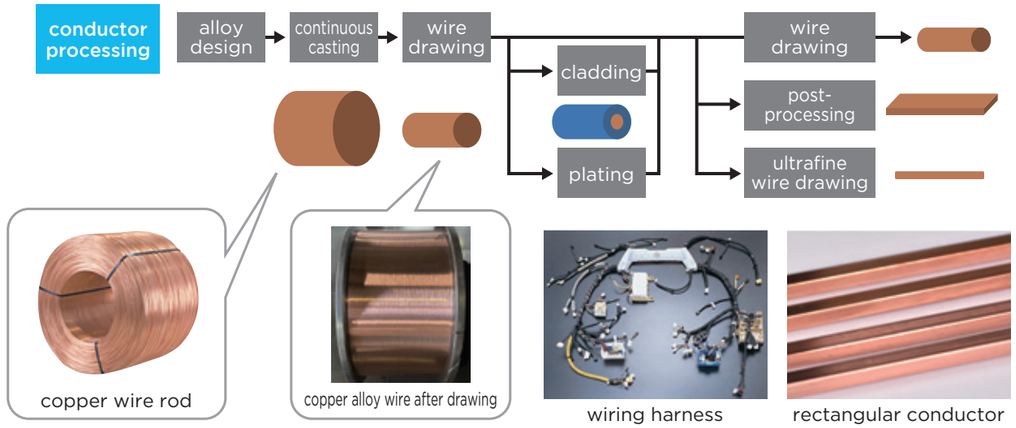
# Energy and Electronics Materials Laboratory

We contribute to the development of products and technologies in the Group's extensive business fields by leveraging our core technologies for metal, inorganic, and polymer materials as well as fine circuit fabrication. Moreover, to contribute to innovative businesses in new fields, we strive to refine and expand our core technologies.




## Metals and inorganic materials technology

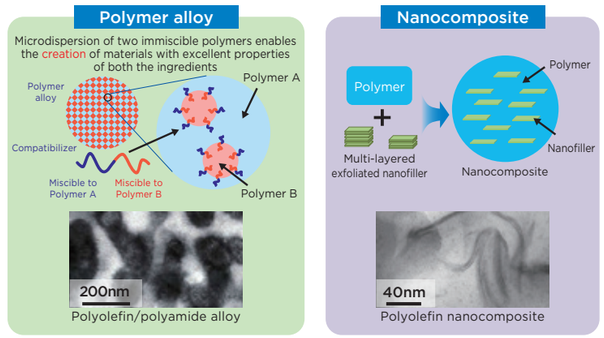
Having developed distinctive conductors using techniques such as continuous casting and plastic processing as well as designing of new alloys and composite material technology dealing with plating and cladding, the laboratory drives Sumitomo Electric's business relating to various types of wiring including wiring harnesses.
In addition, the laboratory has undertaken development of materials and processes helpful towards resources recycling and carbon neutrality.



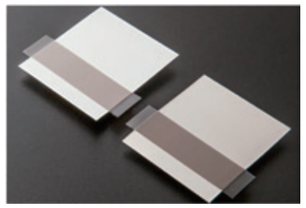

## Polymer material technology

Employing polymer synthesis and resin formulation technologies, we have been developing a wide array of products such as electric wires and cables in the fields of environment & energy, electronics, and automotive, as well as magnet wires for environment-friendly vehicles. We are also working on the development of newly functional and high performance polymer materials through nano-sized material structure control (polymer alloy and nano-composite).

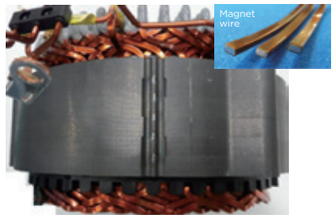
### Polymer synthesis and resin formulation







tab lead


Composite cable for electric powered parking brake



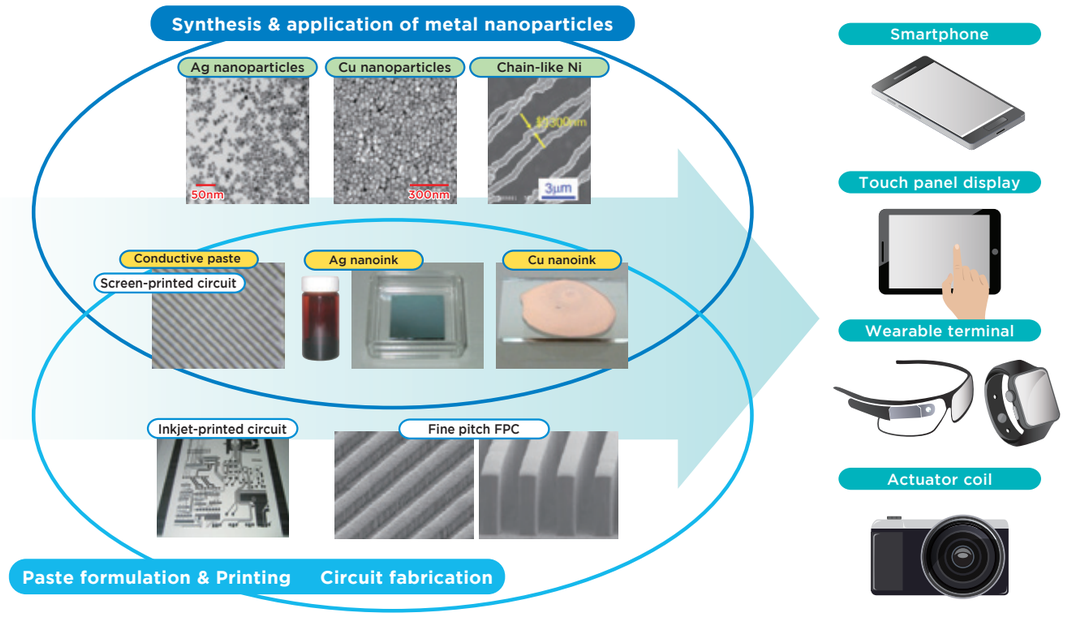
Magnet wires for environment-friendly vehicles


HVDC power cable for interconnector


AC power cable for offshore wind power generation

## Fine circuit fabrication technology

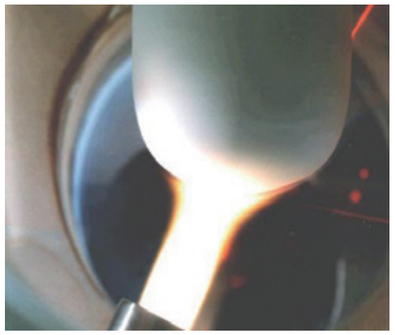
In line with the trend toward higher-density and finer circuits, we are working on development of various metallic nanoparticles and of ink and paste containing such nanoparticles. We are also exploring their application to our electronics products.



# Optical Communications Laboratory

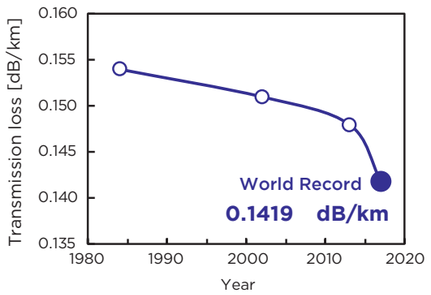
To contribute to the development of a connected society, we are pushing ahead with continuous innovation in optical fiber technologies fundamental to broadband communication networks and their expansion into data centers and households.
We are also working on the application of optical technologies to new fields.

## Optical fiber




Z-PLUS Fiber™ 150

Since the early 1970s, we have developed a vapor-phase axial deposition(VAD) method, a Japanese original technology, to produce optical fibers efficiently. Based on this technology, we have realized wide varieties of innovations including advanced optical fibers and related fiber-based optical technologies.




### Ultra-low loss optical fiber with pure silica core

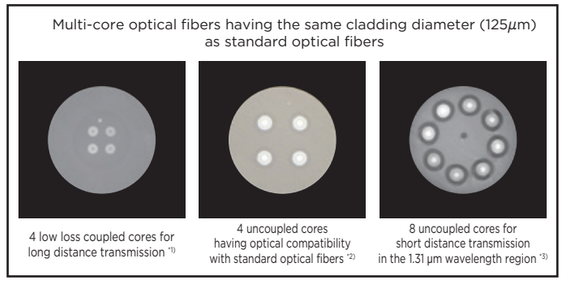
**Our ultra-low loss optical fibers based on ultimately-pure-silica core glass technology are the best mediums for long-distance high-capacity optical communication systems.
They are now widely used especially for submarine optical cables. Through our continuous innovation in glass and coating technologies, we achieved a transmission loss of 0.1419 dB/km at 1560 nm wavelength in 2017. It is still the world record for lowest loss in the field of the solid core optical fibers.**

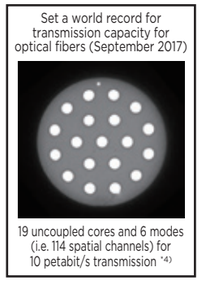


## Next generation optical fibers/Connection technologies

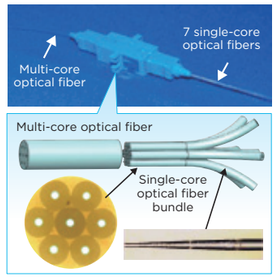
We are conducting R&D in innovative multi-core optical fibers (MCF) and related connection technology that overcomes the limitations of conventional standard single-core fiber and paves the way for petabit optical transmission.

Multi-core optical fibers in practical use



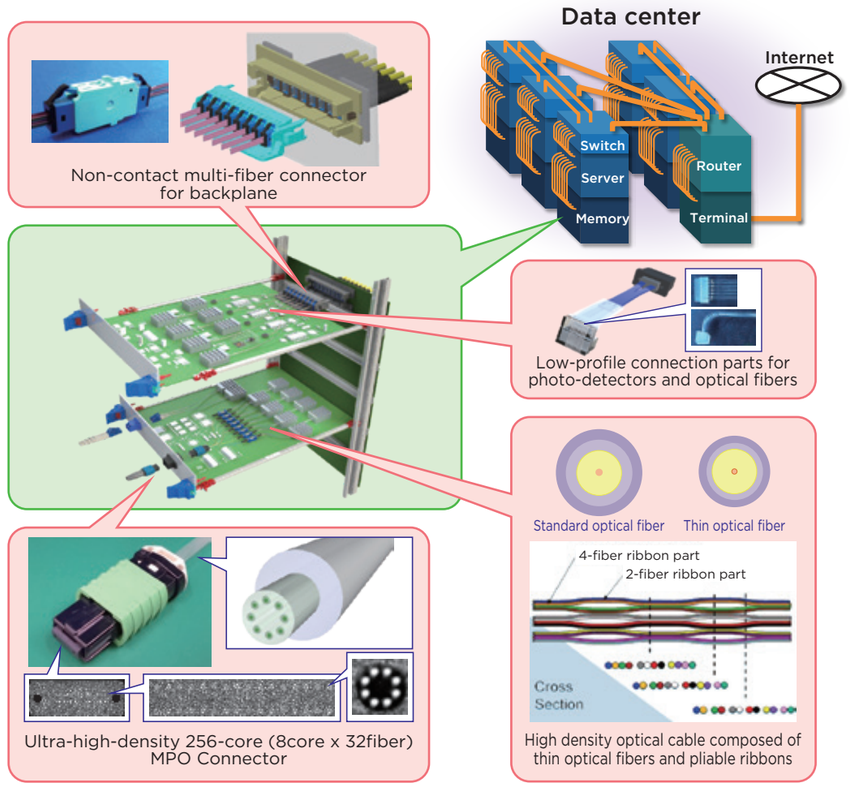

Multi-core/single-core conversion connector




1) http://www.sei.co.jp/company/press/2016/03/prs023.html
2) http://www.ntt.co.jp/news2017/1708/170808b.html
http://www.sei.co.jp/company/press/2017/prs083.pdf
3) http://www.sei.co.jp/company/press/2015/03/prs022.html
4) http://www.kddi-research.jp/newsrelease/2017/092201.html
http://www.sei.co.jp/company/press/2017/prs097.pdf

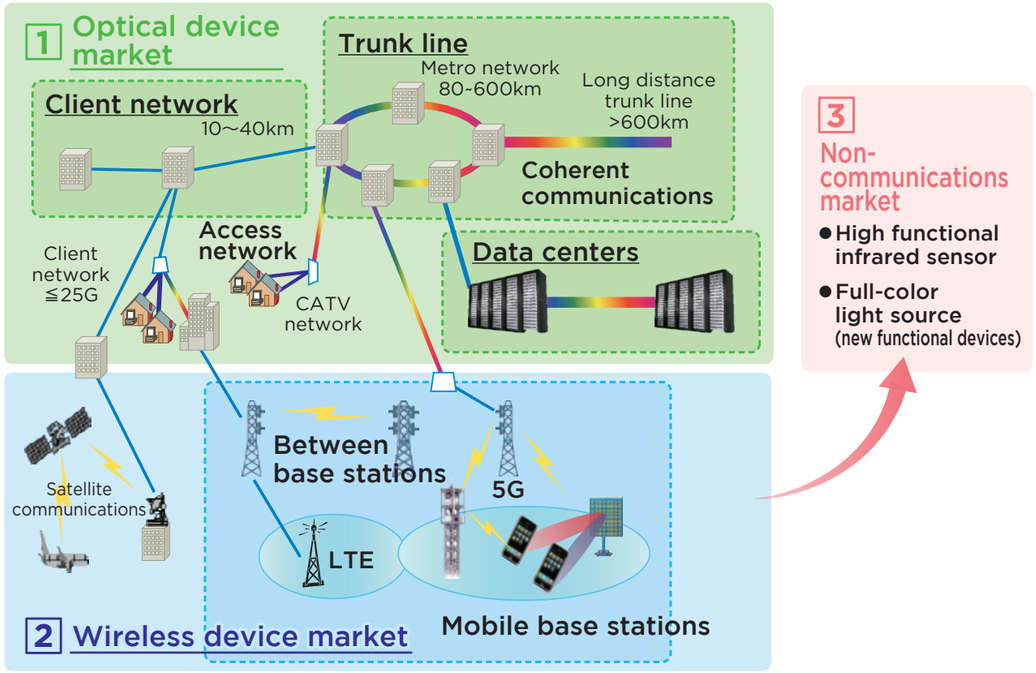
## High-capacity interconnection technologies

We are developing high-capacity interconnections using our metal and optical cable technologies for rapidly expanding data centers, where high speed as well as low power consumption are required.
We are also working on the development of new high speed cables for appliances.



# Transmission Devices Laboratory

Our unique technology encompasses semiconductor crystal growth, epitaxy, processing, high-precision assembly of optical and electronic devices, and optical transceiver design. Using the complete spectrum of technology we possess, we are developing advanced compound semiconductor materials and related products for two major communications markets, that is, optics and wireless. We also aim to enter the non-communications market employing our cultivated elemental technologies.

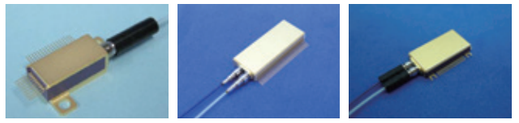



## Compound semiconductors and their applications

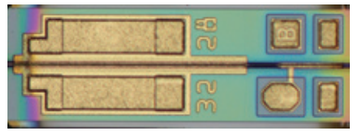
| Material | Photonic device | Electronic device |
|---|---|---|
| GaAs<br>InP | Red laser<br>Visible/Infrared LED<br>(DVD, PC, automotive, outdoor display)<br>Infrared laser/ Photodetector<br>(optical communications) | High frequency IC<br>Power amplifier<br>(mobile phone, wireless base station, satellite communications) |

We are a pioneer in compound semiconductors, which are applied to various products where silicon cannot be used. We have commercialized a wide array of materials, and are now developing a crystal growth process with higher quality and a larger diameter as well as new materials for cutting-edge electronic devices.

## Optical device



Tunable light source | Multi-level modulator | Coherent receiver

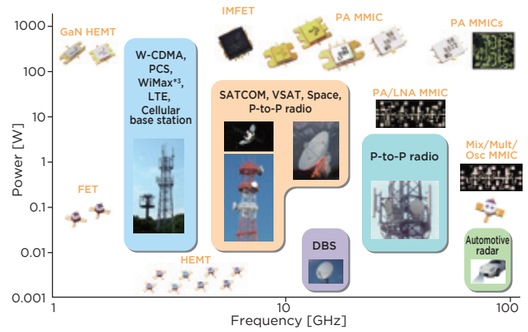


Modulator integrated laser chip

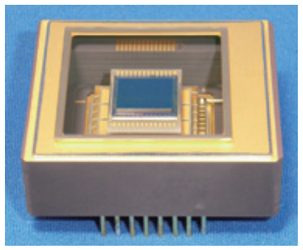
We are developing semiconductor devices for optical-electrical signal conversion in optical communications systems. In trunk lines, digital coherent technology is used to realize 10 Tbit/s-class ultra-high capacity transmission. As key components, we are developing high-power tunable narrow-linewidth light sources, multi-level modulators, and coherent receivers employing our compound semiconductor technologies. For client networks and data centers, we are developing optical subassemblies (OSA) and higher data rate optical transceivers. To cope with the rapid growth of optical network capacity, we are tackling miniaturizing and energy-saving technologies as well as higher transmission speed.

## Wireless device

We developed gallium arsenide (GaAs) HEMTs ahead of our competitors and have supported the expansion of wireless communications. Applying this technology to gallium nitride (GaN), we have greatly contributed to the miniaturization and higher efficiency of 4G(LTE) and 5G base stations. And for next generation wireless networks, we aim to create advanced devices with higher frequency and higher efficiency. In addition, by using high power and high efficiency features, we contribute to realize higher capacity of radio back-haul and satellite communications, and solid state radar.




## Infrared sensing device



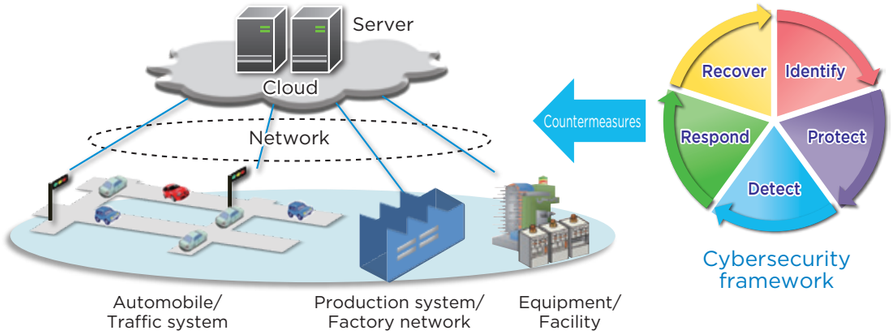
Extremely high sensitivity photodetectors and quantum well infrared imaging sensors with new materials are being developed using elemental technologies of photodetectors for optical communications. We are creating new sensing device markets by realizing higher sensitivity, higher operating temperature, and environment-resistant.

## External activity

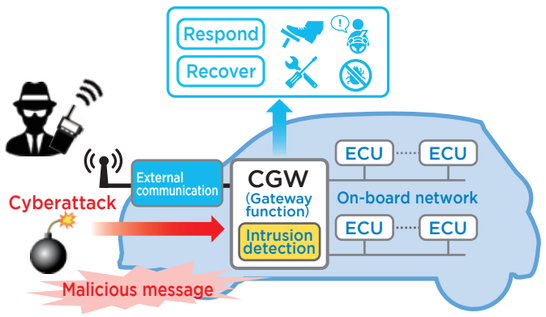
We are actively involved in fostering new research themes by participating in joint research with many universities and private companies and in national projects, as well as participating in and presenting at many academic conferences in Japan and abroad.

# Cyber-security R&D Office

We are developing countermeasure technologies against cyber attack for our products and production facilities in our five business segments, that is info-communications, automotive, environment and energy, electronics, and industrial materials.

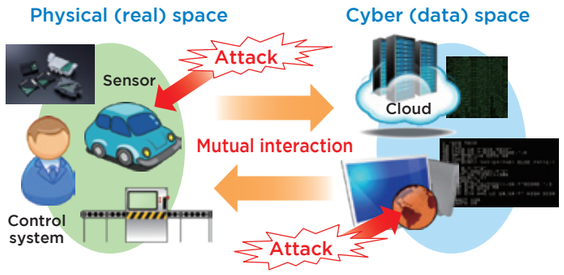



## Automotive security




Cybersecurity for automotive has grown in importance due to the widespread adoption of auto pilot technologies and connected vehicles.
We are conducting R&D in automotive cybersecurity, especially cyberattack countermeasures in vehicle.
We are focusing on intrusion detection technologies for ECUs and communications by using network analysis and/or machine learning and the latest cryptography.

## Cyber-physical security

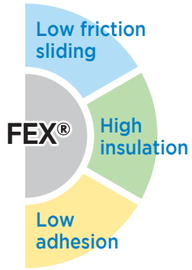



Wide spreading IoT has brought about an expanding interaction between physical space and cyberspace, and new threats, such as cyber-physical attacks and physical-cyberattacks, are emerging. New security measures are required.
Our efforts are directed toward developing countermeasure technologies from both hardware and software.



# FEX Development Office

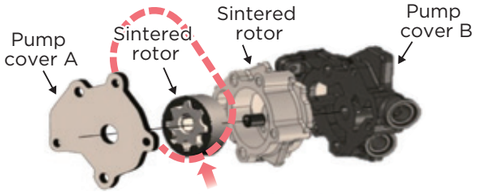
We develop materials for a cross-linked fluororesin named FEX®, which outperforms ordinary fluororesins in wear resistance and bonding, and enhance improve its coating accuracy and build up productivity.
Striving towards expanding applications for FEX®, we promote new product development as we work closely with different R&D and business units within the company. Industries such as the consumer, automotive and die-and-mold sectors are the target area of our current development applications for FEX® where FEX® can offer an outstanding performance.




| | |
|---|---|
| Low friction sliding | Improve performance of friction parts in dry or liquid lubrication |
| High insulation | Improve insulation performance of wires and rectangular wires |
| Low adhesion | Reduce foreign object adhered, improve better removal of molds for rubber/resin |

## Cross-linked fluororesin coating, tape and sheets

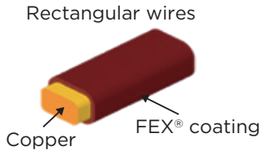
Carbon neutrality is a growing trend in the automobile and the consumer industries. Reflecting the trend, there is a growing need of sliding loss reduction. FEX®'s advantages such as low friction, wear resistance and burning resistance attract demand for products that reduce sliding loss. FEX® is also has excellent in water/oil repellency, non-adhesiveness and low friction. Such advantages are attractive in reducing foreign material adhesion and achieving better rubber/resin removal from molds and lower dust emission.Besides FEX® coating, we develop its tapes and sheets as well.




FEX® coated on both ends of a gear rotor.
Example application of FEX® in the oil pump of a vehicle

FEX® Tape

## Low dielectric constant rectangular wire with fluororesin insulated coating




Structure Of rectangular wire

Driving motor for electrified vehicle

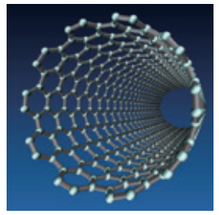
As electromobility makes rapid progress, a highly insulated coating material able to withstand high voltage is required for magnet wires built in automobile drive motors. Since fluororesin is an excellent high insulation material with a minimal level of dielectric constant in solid, we conduct development of material and production engineering for FEX® to coat a magnet wire as an insulating layer for rectangular wires in driving motor for electrified vehicles.

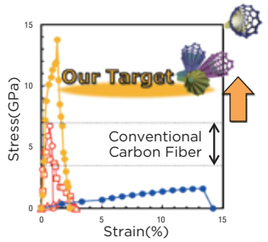
# Frontier Technologies Laboratory

Predicting future social needs through the study of world trends including SDGs, DX and GX, we are developing revolutionary technologies that will be required for our business in the future.

## Carbon Nanotubes for Next Generation Wire

Applying highly oriented carbon nanotube (CNT) technology, we have succeeded in the synthesis of ultra-strong wire with 10 GPa tensile strength, which is two times higher than conventional carbon fiber. Employing our CNTs, we will contribute to the realization of space elevators that enable future space travel.

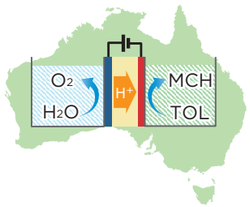






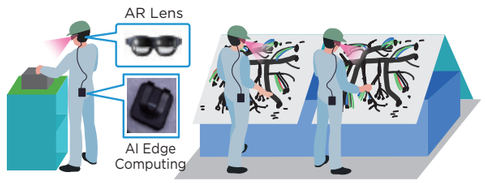
## Hydrogen Society and Hydrogen Production

Hydrogen is a clean energy source which emits no greenhouse gases. We are conducting research on the cost reduction of mass production of hydrogen, constructing a demonstration system in Australia known for its plentiful sunshine.



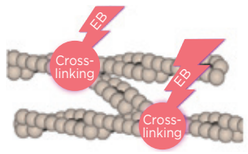

## CORE-DX (Digital Revolution)

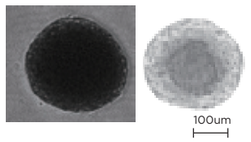
Employing cutting-edge DX and AI technologies, we are tackling the realization of next generation smart factories with extended reality (XR), and the creation of new products and new businesses. By solving social issues using DX, we will construct a future society in which everyone can enjoy a high quality life, and achieve the SDGs.




## Other Technologies

To apply multi-material concepts to future mobility systems, we are developing cross-linked fluoropolymers with low friction and abrasion resistance.
Aiming to develop our future business of cell inspection systems, we are conducting research on non-destructive observation of cell structures and cell quality evaluation using AI.




Left: Microscope image
Right: Image using our technology



# R&D Planning & Administration Division

Aiming to carry out our long-term management plan (2030 VISION) that sets forth the managerial direction of our group company, we administer projects based on the achievements of our R&D unit. For the development and growth of our technologies and business areas, we support the launch of new research initiatives and commercialization of the results of our developments. We also promote collaboration within our group, joint research with universities and research institutions, participation in national projects, and cooperation with other companies. Regarding the US and Europe, we have set up local bases, where we gather the latest information, and encourage entry to development projects. Furthermore, we hold training workshops to nurture future leaders and networking between them.

# Overseas Operations

## Innovation Core SEI, Inc. (ICS)

## SEI Automotive Europe GmbH Innovation Core Department (ICS-Euro)

Innovation Core SEI
2355 Zanker Road, San Jose CA USA
TEL: +1-408-232-9511

SEI Automotive Europe
Gustav-Stresemann-Ring 1, 65189 Wiesbaden, Germany
TEL: +49-611-1677-1800

San Jose Office

Wiesbaden Office

ICS, which serves as the overseas R&D base of the Sumitomo Electric Group, has offices in the United States and Europe. ICS aims to be a source for Sumitomo Electric's innovation. By leveraging the advantages of these locations, ICS can quickly perceive dynamic changes in technology and market trends. By engaging in open collaboration with local partners while working closely with the laboratories in the Japan headquarters, ICS supports the development and commercialization of "energy", "mobility", "new materials" and "next-generation optical communication“ technologies.

## China Analysis Technology Center

No.232 Jinfeng Road, SND, Suzhou, Jiangsu, China
TEL : +86-512-6665-3090

The China Analysis Technology Center is located in Suzhou, east China, and provides analytical support for the production and development of our group in China.

The China Analysis Technology Center is located in the Sumitomo Electric Interconnect Products (Suzhou) Ltd. (SESZ) building.