Awards

2016/04/12

AIST wins three Science and Technology Awards in the 2016 Minister of Education, Culture, Sports, Science and Technology Commendation for Science and Technology

At the 2016 Minister of Education, Culture, Sports, Science and Technology Commendation for Science and Technology, the National Research and Development Agency, National Institute of Advanced Industrial Science and Technology (President: Ryoji Chubachi) (hereinafter referred to as "AIST") received a total of three Science and Technology Awards, one in the Development category and two in the Research category. The purpose of these awards is to raise the motivation of those involved in science and technology by honoring their achievements in research and development and promoting understanding of science and technology, thereby contributing to improving the level of science and technology in Japan.

The award ceremony is scheduled to be held at the Ministry of Education, Culture, Sports, Science and Technology on April 20th.

Congratulatory speech by Deputy Minister of Education, Culture, Sports, Science and Technology Tomioka

[Development Division]

AIST Nanotube Practical Research Center
Kenji Hata,
Director Morio Yumura, Chief Researcher
Don Norimi Futaba, Research Team Leader

Zeon Corporation
Kohei Arakawa, Special Corporate Technical Officer Mitsugu
Ueshima, Director, CNT Research Institute, General Development Center

"Award-winning achievement: Development of mass production technology for single-walled carbon nanotubes using the super-growth method"

Single-walled carbon nanotubes (single-walled CNTs), discovered in Japan, have excellent physicochemical properties and are expected to be the core material of the next generation. However, due to extremely low synthesis efficiency, they have not yet been commercially produced as a full-scale industrial material.

In this development, a synthesis method (super-growth method) was developed to obtain high-purity, long single-walled CNTs by improving the synthesis yield by 1,000 tim the conventional method by adding a very small amount of moisture to the synthesis atmosphere. The development of basic technologies such as coating catalysts, contir synthesis, and large-area synthesis technology has realized an industrial mass production process for the super-growth method.

This development has made it possible to commercially produce super-growth single-walled CNTs, and applications such as CNT supercapacitors and medical and welfare devices using CNT-rubber composite materials will be put to practical use one after another.

This result demonstrates that the excellent properties of super-growth single-walled CNTs are extremely diverse and in many cases far surpass those of known materials,

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leading to a wide range of applications in areas such as energy, environment, and IT, and contributing to strengthening Japan's industrial competitiveness from a materials perspective.

[Research Division]
AIST Inorganic Functional Materials Research Division
Kazumi Kato, Chief Researcher

"Award-winning achievement: Research on nanocrystal creation and device fabrication based on solution science"

Electronic and chemical devices using nanoparticles face technological barriers in terms of their difficulty in further miniaturization and performance due to the negative size effect and instability caused by non-uniform particle size and surface defect layers.

In this study, based on precise solution chemistry, we synthesized nano-sized single crystals, "nanocrystals," characterized by their shape and size through the formation of precursor structures, crystal growth control using surfactants, stabilization of polar and non-polar fields, and self-organization induced by solvent evaporation, and provided guidelines for their application in high-performance small devices.

This study revealed that an integrated film of cubic single-crystal barium titanate nanocubes with sides of 15 nm stacked in a three-dimensional order exhibits dielectric properties exceeding those of barium titanate single crystals due to the synergistic effect of the pseudo-coherent interface formed between the nanocubes and high-quality nano-sized single crystals. In addition, by controlling the shape and integrating cerium oxide nanocubes with sides of 5 nm, we confirmed the formation of a porous structure including facet pores, demonstrating the possibility of high-temperature stable and high oxygen storage capacity.

This result is expected to contribute to future society as the core of next-generation technology, as it will lead to a leap that is not merely an extension of existing technologies in a wide range of industrial fields, including electronic ceramic elements and catalytic components.

Dr. Kazumi Kato, Chief Researcher, receiving the honor from Vice Minister of Education, Culture, Sports, Science and Technology Tomioka as the research division representative

[Research Division]
AIST Spintronics Research Center
Director: Shinji Yuasa

"Award-winning Achievement: Research on Giant Tunnel Magnetoresistance Effect"

The discovery of the giant magnetoresistance effect, a Nobel Prize-winning technology, has made it possible to apply the magnetoresistance effect, which uses magnetism to control electricity, to industrial applications. However, the fact that the magnetoresistance ratio, which indicates the performance of the magnetoresistance effect, is only a few tens of percent at room temperature has been a serious problem in its application.

In this research, a new type of tunnel magnetoresistance element was developed using crystalline magnesium oxide (MgO) as the tunnel insulating film, and a giant tunnel magnetoresistance effect of approximately 200% at room temperature was realized for the first time in the world. Furthermore, in collaboration with a manufacturing equipment manufacturer, mass production technology was developed that combines MgO and the magnetic alloy CoFeB, making industrial applications of MgO tunnel magnetoresistance elements possible.

As a result of this research, magnetic sensor elements using MgO tunnel magnetoresistance elements have been put to practical use, and are now used in all hard disk storage devices (HDDs) currently being manufactured, resulting in a dramatic increase in HDD capacity, lower prices, and reduced power consumption. Furthermore, it is expected that non-volatile memory STT-MRAM using this technology will also be put to practical use in the near future.

This result is expected to contribute to improving the performance of next-generation IT devices, reducing power consumption, improving convenience, and realizing a safe and secure IT society.

*Part of this research result was obtained with support from the Japan Science and Technology Agency (JST), the New Energy and Industrial Technology Development Organization (NEDO), and the Impulsing Paradigm Change through Disruptive Technologies Program (ImPACT).

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