August 2013

この記事は、特定の研究内容にフォーカスした科学技術に関する内容です。具体的には...

詳細な内容は、図や表に示されています。
February 2014

The title of the document is "Photocatalyst for Indoor use: Enhancing Living Spots."
図13：色を変えて、模型と実物の形状を比較検討した結果

図14：形状の比較検討

図15：形状の比較検討
February 2012

A New Approach in Equipment Enabling Automatic
Handling and Loading
A CLASSROOM APPROACH TO ALL繞 for a 12 Topic Subject
A CLASSROOM APPROACH TO ALL繞 for a 12 Topic Subject

February 2009
November 2010

Trends in Eastern Energy

Research and Development

...
Method for synthesizing highly pure and long single-walled CNTs was created. The key features of the 5G method are its production efficiency and high level of purity. Compared to conventional methods, the 5G method can synthesize CNTs 1000 times more efficiently with a purity of 99.98%. With this method, single-walled CNTs are created on substrate. However, the substrate was initially as small as 5 mm square. In order to allow this method to be used for the mass production of CNTs, it was necessary to overcome major technological problems such as increasing the area of substrate and realizing continuous synthesis. Therefore, Mr. Yumura and Mr. Hata chose Kohei Arakawa of Zeon Corporation to assist in the joint research. Mr. Arakawa had already been credited with several inventions as a CNT researcher, but he had to give up CNT research because of a shift in policy at his former employer. At the time, research and development of CNTs was a new initiative for Zeon Corporation. Recalling the passion that he had for his past work, Mr. Arakawa decided to join the Carbon Nanotube Capacitor Development Project (FY2006–FY2010) as the leader of technical development for mass production. In order to achieve effective cooperation among industry, academia, and government and aiming at practical application of a production method, AIST identified necessary human resources and Zeon Corporation recruited professionals working in thermal fluid simulations and catalysts. This was important because technologies related to thermal fluid and catalysts were thought to be the key to successfully enlarging the size of substrate for enabling continuous synthesis. The utilization of such technologies increased the size of substrate from 5 mm square to 4 cm square, then to 50 cm square, which solved the problem of continuous synthesis. The technology for mass-producing single-walled CNTs was thus established. In 2010, the Project for Practical Application of Carbon Nanomaterials for a Low Carbon Emission Society (FY2010–FY2016) was started with Mr. Yumura as the project leader. A group of companies aiming at practical application of CNTs also founded the Nanotechnology Research Association for Single-Wall Carbon Nanotubes (TASC). Zeon Corporation and AIST, as members of the association, promoted the development of practical application of single-walled CNTs through open innovation. In addition to technology for mass production, progress was also made regarding application products and safety management. Zeon Corporation and AIST also succeeded in developing composite materials that have superior heat tolerance and thermal and electrical conductivity by mixing single-walled CNTs with rubber, aluminum, and copper. As various types of sampling were developed, the response to the need for single-walled CNTs was realized. Furthermore, manuals necessary for the safe management of single-walled CNTs were compiled. The manuals were also used to explain to local governments and residents about the approaches to safety taken for constructing new factories.

In November 2015, the ambitious goal of producing CNTs became a reality as Zeon Corporation completed the world’s first mass production factory for high-quality single-walled CNTs using the 5G method. According to a survey conducted by the NEDO Technoindustrial Science and Technology Center, the world market for CNTs is expected to expand to 66 billion yen by the year 2030. There are high expectations for Japan to produce numerous products that apply single-walled CNTs to help enrich the future of society.

Success in expanding substrate to 50 cm square leads to construction of factories for mass production

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In the chemical industry, the conventional way of manufacturing chemical products has been to induce chemical reactions by applying heat and pressure from the outside. However, the research and development activities of this project resulted in innovative new manufacturing processes for chemical products using microwave technology. This result, long considered difficult to achieve, led to the construction of the world’s first chemical plant using microwave technology.

The challenge of scaling-up of microwave reactors and designing manufacturing processes

Conventional manufacturing processes for chemical products using heat and pressure require vast amounts of energy. However, microwave-induced chemical reactions can cause thermal energy to be produced from materials being microwaved in the same way as a microwave oven and can thus save a significant amount of energy. Microwave Chemical Co., Ltd., a venture company spun off from Osaka University, joined a NEDO project in FY2007 with the goal of achieving commercial application of manufacturing processes that use microwave technology.

The company confronted the two technical challenges of scaling up of microwave reactors and designing manufacturing processes. To increase the size of reactors, the company developed a horizontal-flow reactor based on the company’s own engineering technologies and know-how. Since microwave absorption property differ depending on the microwave frequency, materials to be microwaved, and temperatures of materials, irradiation processes must be designed in advance. To do this, the company found it useful to apply its years of archived data detailing absorption property which vary according to the combination of materials, temperatures, and microwave frequencies.

Construction of the world’s first microwave plant and development of products that can only be created by using microwave technology

Microwave Chemical overcame its two technical challenges and completed construction of the world’s first full-scale mass production plant using microwave technology in 2014. The plant had a huge impact on the chemical industry because its energy consumption was just one-third that of a conventional plant, the heating time one-tenth, and the plant footprint one-fifth. The company is now engaged in the research and development of graphene, silver nanowire, and other next-generation materials to produce high value-added materials using its microwave platform technology. Microwave platform technology is expected to foster future innovation in the chemical industry.

World’s First Commercialization of Mass Production Processes Using Microwave Technology

Revolutionizing the Chemical Industry for the First Time in 100 Years

Microwave Chemical Co., Ltd.

New Energy Venture Business Technology Innovation Program
The possibility of maximizing a drug's efficacy increases if that drug could be released around the affected area. With that in mind, this project brought the commercialization of Fuwari, an innovative hair restorer for women, by using drug delivery system (DDS) technologies that optimize drug delivery routes and maximize efficacy. Hair loss and thinning are not life-threatening issues, but they are serious enough to affect one's quality of life (QOL). The results of this project are attracting attention as a way of improving this QOL for women.

From endermic absorption enhancers to hair restorer, the R&D NANOEGG Research Laboratories, Inc., a company that has been conducting research and development on endermic absorption enhancers using DDS technologies, developed this hair restorer. The company had previously developed NANOEGG® technology, which is a method to encapsulated drugs with special coating. Not only does this technology enable drugs to be delivered to affected area with no efficacy loss, the use of nano-capsules enhances permeability of the active ingredient when applied to the skin.

NANOEGG Research Laboratories also developed NANOCUBE®. This is a base material that creates entry pathways for drugs and active ingredients by inducing a temporary phase transition in the lamellar structure of intercellular lipids, thereby enhancing skin permeability. The company built a business around these two technologies by applying them to develop and sell skincare products. The idea of developing a hair restorer came up when a certain phenomenon was discovered during a study on NANOCUBE®. Researchers found that hair can grow on hairless mice when NANOCUBE® is applied, and they concluded that the application of this phenomenon could lead to the development of a novel hair restorer.

Investigating hair growth mechanisms, confirming hair restoration effects through clinical studies

In order to develop a hair restorer that could be commercialized, the company applied to participate in NEDO's Innovation Promotion Project. During the project, the company worked to determine mechanisms on how NANOCUBE® enhances hair growth. It simultaneously sought to establish basic drug formulation techniques. As a result the company discovered that collagen levels are low on areas of scalp with hair loss and thinning, and that collagen is essential to promote hair growth. It was also discovered that NANOCUBE® inhibits the decomposition of collagen. Based on the idea that efficient delivery of NANOCUBE® into the scalp would help inhibit collagen decomposition, the company developed a hair restorer in mousse form to apply directly to the scalp. After NEDO’s project was completed, the company conducted a clinical study to assess hair restoration effects before bringing the product to market. Each hair sample from test subjects was measured to ascertain the effects of the hair restorer. It was confirmed that hair restoration effects, such as development of thicker, stronger hair, were statistically significant. Fuwari was then introduced to the market in 2016 as a hair restorer for women.

(Interview conducted in October 2017)