NEWS RELEASE

PRESS RELEASE

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Gifu University, National University Corporation

Gifu University Creates CFRP Recycling Technology
Energy-Saving/Cost-Reducing Improved Safety
World's Largest CFRP Recycling Center Planned for Gifu

The research group of Professor Hiroshi Moritomi at the Gifu University Composite Materials Center (GCC; Takushi Miyake, Center Director) has announced its creation of a "two-stage thermal decomposition process", a world-class energy-saving, economical CFRP recycling technology, as well as plans to build the world's largest CFRP recycling facility in Gifu Prefecture in partnership with Carbon Fiber Recycle Industry Co., Ltd. (CFRI; Hidehito Itadu, Representative). Gifu University (Hisataka Moriwaki, University President) is a National University Corporation and located in Yanagido, Gifu City, Gifu Prefecture.

■ About CFRP

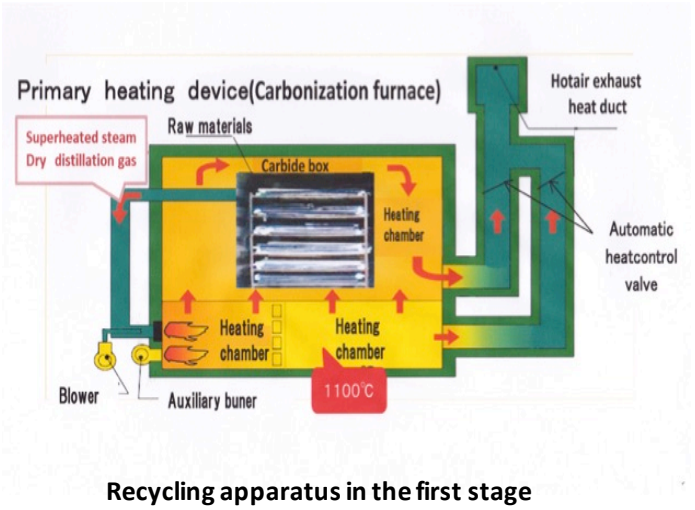
Materials disposal is an increasing problem associated with the expanded use of CFRP (carbon fiber-reinforced plastics) as a substitute for steel or aluminum in applications such as aircraft and automobile bodies where light weight and high strength are demanded.

Recycled carbon fibers

Japan itself produces 1000 tons of CFRP waste annually. During recycling, CFRP must be processed into small pieces, which increases cost and has also created problems in safety. As a result, nearly all CFRP is currently disposed by means such as landfilling.

■ "Two-stage thermal decomposition process ": A technology for high-efficiency recycling

The two-stage thermal decomposition process is an application of "ibushi roof tile" technology, which involves slow firing under air feeding. In the first stage, a recycling apparatus gasifies the resins in CFRP through thermal decomposition. In the second stage, residual carbon fibers that cannot be gasified are slowly combusted. This two-stage process allows recovery of carbon fibers without damage.



Recycling apparatus in the first stage

Data obtained also show that recycled carbon fibers produced through this process retain approximately 80% of the strength of new fibers. Demonstration of this technology is still continued by the support of NEDO.

■ The two-stage thermal decomposition process: Three advantages

1. Fuel cost 1/30 that of existing technologies

In the first processing stage, the gases produced by thermal decomposition and gasification of CFRP can be used without modification as a fuel for thermal decomposition. In conventional recycling processes, the need for fuel at each stage of the process leads to high costs, but in the technology developed, the ability to obtain fuel from the processed material allows a major reduction in fuel-related costs. Specifically, results show that consumption of kerosene, the fuel for the recycling apparatus, is reduced by approximately 50%, and electricity costs are reduced by approximately 70%; according to calculations, the resulting cost is approximately one-thirtieth that when carbon fibers are manufactured from petroleum or coal.

2. Reduced risk of harm to human health

While conventional techniques include a process for fine pulverization during CFRP processing, the technology developed requires no pulverization process. As a result, inhalation of airborne dust is reduced, as are other risks of harm to human health.

3. Standardization of quality

The technology developed allows processing of material in bulk form, with no need to pulverize the waste material. And because the carbon fibers remaining after the recycling process retain a large, long shape, more precise strength experiments can be performed, and the quality of recycled CFRP can be standardized.

■ CFRP recycling facility

This facility will be established through cooperation between Gifu University, which will contribute recycling technology, and the CFRI, which will secure a facility serving as a base to stockpile waste materials and for shipping. The processing facility in Mitake Town, Kani-gun, at a scale of approximately 2000 tons per year, will be the world's largest such facility.

Facility External view

This scale is a processing capacity capable of recycling all of Japan's current CFRP waste material, and plans call for full-scale operation achieved by continuous operation of the "two-stage thermal decomposition process" by 2020. The facility will be approximately 56,000 m² in size.

■ Current issues and prospects for practical application

While Japan holds a nearly 70% share of the world market for carbon fiber production, we believe that Japan has an obligation to develop recycling technologies, and that this developed technology will come to represent the core of future CFRP recycling technologies. Gifu University and the planned facility will establish links with carbon fiber manufacturers and users while continuing research on specifications and standardization to ensure the quality of recycled carbon fibers, and likewise, work environments and effects on health.

Given its advantage in allowing major cost reductions for items with reduced strength, the path to practicality will likely allow application for items which can be used without requirements for high strength, for example, lightweight materials

for automobiles, repair or reinforcement materials for cracks in tunnels or elsewhere, or highway sound barriers. Through cost reduction, we also intend to continue research and development aimed at allowing the use of previously unusable materials, and improvement of strength through means such as combination with virgin fibers.

■ Profile: Professor Hiroshi Moritomi

MS, Graduate School of Engineering, Nagoya Institute of Technology, 1979. PhD in Engineering, Hokkaido University. Assistant at Coal Research Institute, Faculty of Engineering, Hokkaido University. Since 1988, participant in research and development and in international cooperation on coal liquefaction and gasification though the MITI -AIST (currently the National Institute of Advanced Industrial Science and Technology) and its New Sunshine Program. Assumed post as Associate Professor in the Gifu University Faculty of Engineering, Applied Chemistry Division, 1995; currently Senior Professor. Awards and achievements include: The Japan Institute of Energy Award for Progress (February 1996), The Japan Institute of Energy Award for Distinguished Paper (February 2006, February 2011), and The Japan Institute of Energy Award (February 2010); academic paper prize of the 6th International Symposium & Exhibition on Gas Cleaning at High Temperature (October 2005); technology prize of the Research Council on Recovered Resource-Based Manufacturing (December 2011); academic paper prize of the Combustion Society of Japan (December 2013), and merit award of the Japan Society of Material Cycles and Waste Management (May 2014). Previously served as Director of the Japan Institute of Energy, and Tokai Branch Chair of the Society of Chemical Engineers, Japan. Currently serving as the Japanese representative to Group of Technical Experts for the Minamata Convention on Mercury of the United Nations Environment Programme.

■ **University Profile**

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