

# OPACK Mail

Organization for Promotion Academic City by Kyushu University

<http://www.opack.jp/>

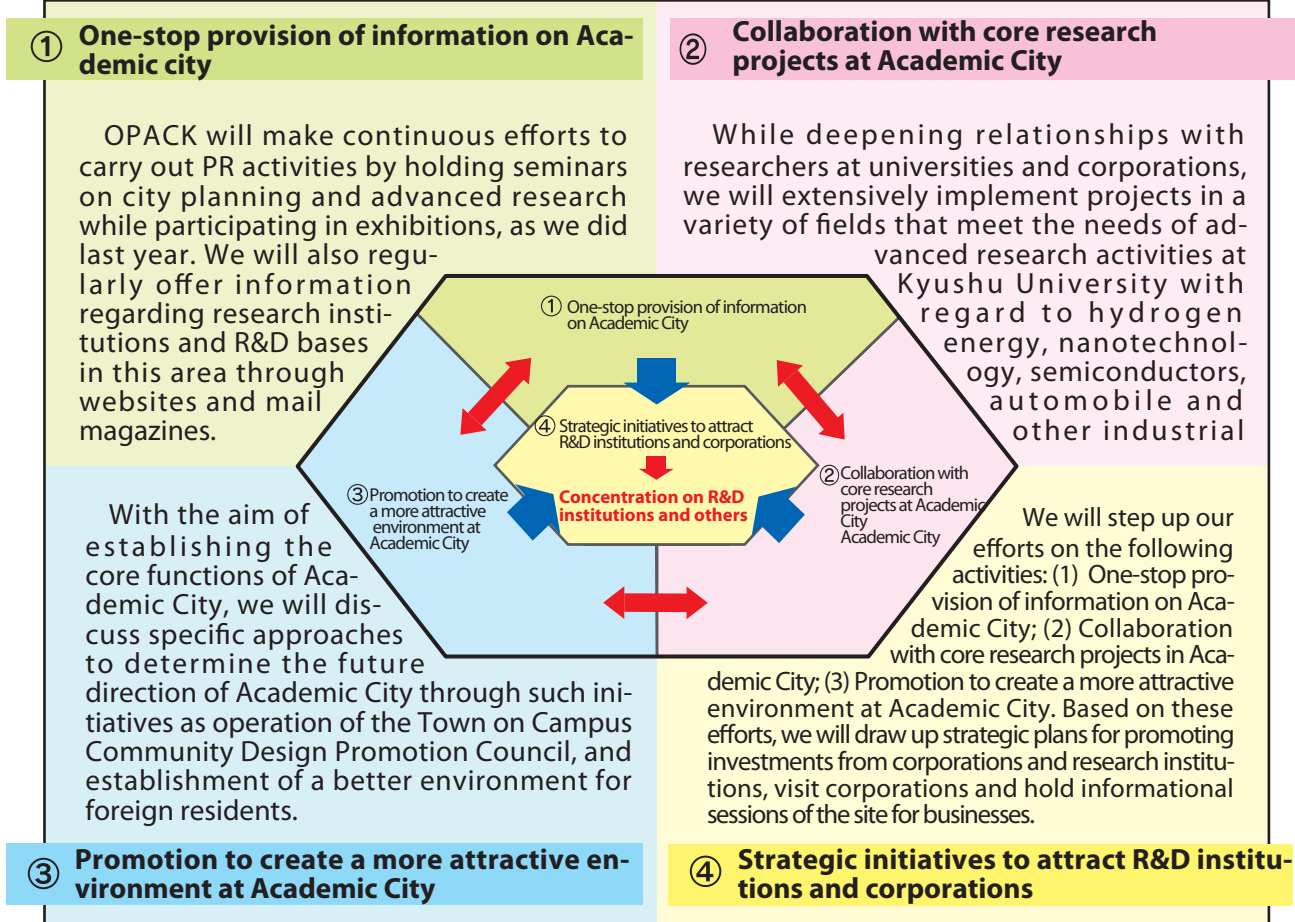
Toward the city where knowledge and nature resonate

## OPACK Operational Plans for FY 2012

In line with the town planning project of Kyushu University Academic City, the Organization for Promotion Academic City by Kyushu University (OPACK) strives to establish “a hub of research institutions, City for bringing about new innovations, City with an environment conducive to research and development”. In cooperation with various parties among industry, academia and government, we are promoting the Academic City Plan by offering one-stop provision of information on Academic City, Collaboration with core research projects at Academic City. At the same time, various efforts are being made to create a cluster of R&D institutions thorough strategic investment promotions while developing an attractive environment for corporations and research institutions.

Against this backdrop, research projects which are mainly conducted in Academic City, have been included in the one of the projects of the Green Asia Special Global Strategy Synthesis Area , a joint initiative between Fukuoka Prefecture, Kitakyushu City and Fukuoka City, which was designated by the central government after applying last December. We are seeing new progress at Academic City, where new developments are beginning to take shape.

By seizing this opportunity, we will further enhance cooperation among industry, academia, and government in the local community, and actively facilitate public relationships, research activities, support exchange and invest in promotions that placing importance on the following aspects:





## Activity Report

### The 17th OPCK exchange seminar

**“Metabolism and functions of sphingolipids and unsaturated fatty acids - Keys for development of functional foods, drugs and bio-energy”**



Photo:Lecture at the seminar

On Tuesday December 13, 2011, OPACK held an exchange session at seminar room where interesting research projects were presented. The results of these projects, which are expected to become commercialized as well as contribute to society, were introduced to local businesses in attendance. The title of the 17th seminar was “Metabolism and functions of sphingolipids and unsaturated fatty acids- Keys for development of functional foods, drugs and bio-energy”. We invited Professor Makoto Ito, who is working in the specialized research fields of bioscience as well as marine science and technology, while actively engaging in industry-academia collaboration. He gave a presentation on the functional role of sphingolipids and unsaturated fatty acids from the perspective of fundamentals and applications.

Fats are indispensable for the living body not only they as a source of energy, but also as key molecules for maintaining living organisms, which has become evident in recent studies. Sphingolipids have attracted much attention due to their potential for development of drugs, cosmetics, functional foods and materials. Utilization of fatty-acid produced by marine microorganism as source of bio-energy was also explained.

### Networking event for research institutions and corporations based in Kyushu University Academic City held

OPACK held an exchange event for research institutions and corporations at the OPACK seminar room on Thursday, January 19, 2012.

The event was held for the purpose of making Academic city more attractive by offering opportunities for corporations, research institutions based in Academic city and various parties from industry, academia and government, which provide support for above-mentioned parties, to exchange their views and strengthen relationships through face-to-face interactions.

This seminar brought together participants from: the Intellectual Property Management Center of Kyushu University; the Research Center for Hydrogen Industrial Use and Storage (HYDROGENIUS); the Fukuoka Fisheries and Marine Technology Research Center; the Fukuoka industry-academia Symphonicity; the Hydrogen Energy Test and Research Center; the Experimental Center for Social System Technologies; Research Center for Three-Dimensional Semiconductors; and OPACK.

Participants exchanged information about progress of the Academic City Plan through explanation of ongoing developments at Academic City, which was given by OPACK and introduction of various activities which were presented by attending organizations.

We will hold such exchange events on a regular basis to reinforce our relationship. By doing so, we can create a framework that will enable us to more closely work together to make proposals and carry out PR activities.



Photo:Exchange event

### 10th General Assembly of the Tokyo conference for the promotion of Kyushu University Academic Plan held

The 10th General Assembly of the Tokyo conference for the promotion of Kyushu University Academic Plan was held on Friday, January 27, 2012 at Prince Sakura Tower in Tokyo.

The Tokyo conference is held annually in order to seek the advice from opinion leaders living in the metropolitan area to promote the realization of the Academic City Plan. At the conference, Katsunosuke Maeda, president of the Tokyo conference (Honorary Chairman, Toray Industries, Inc); Shingo Matsuo, Chairman of Kyushu Economic Federation; Setsuo Arikawa, president of Kyushu University and board members of OPACK were attended.



Photo:Tokyo conference

During the conference, an explanation about the Kyushu University Academic City Plan was presented by President Odawara of OPACK. Together with his explanation, notable examples from the Academic City Promotion Plan were introduced by Professor Seiji Ogo of Kyushu University, who developed the world's first nickel catalyst with his research group on the Ito Campus of Kyushu University and at Fukuoka Industry-Academia Symphonicity, a main base for his research. At the conference, the participants also gave us valuable insights and feedback about what needed to be done to further promote the Academic City plan.

Since the conference marked the 10th anniversary of this occasion, we decided to make it the last one. We sincerely appreciate your support and cooperation regarding efforts we have made.

## Joined nano tech 2012

OPACK participated in "nano tech 2012", which was held from Wednesday, February 15 to Friday, February 17, 2012 at Tokyo Big site. This exhibition attracted a large number of nano-tech related corporations, from both, at home and abroad. During the exhibition, OPACK presented research at Kyushu University and other institutions, as well as the attractiveness of Academic City in an integrated fashion. At the OPACK booth, a panel exhibition and DVDs were displayed, giving an explanation on the current status of research institutions and associated information on Academic City.

Since OPACK presented a joint exhibition with the Center for Organic Photonics and Electronics Research (conducted by Professor Chihaya Adachi), and the Institute of Systems, Information Technologies and Nanotechnologies (ISIT), Nanotechnology Lab, researchers from those institutions at the booth explained their own research concepts to visitors. In addition Fukuoka Nano Technology Promotion Conference introduced its initiatives to promote nanotechnology-related industries while member companies presented their own projects. Our booth attracted a lot of attention since we had about 1500 visitors.

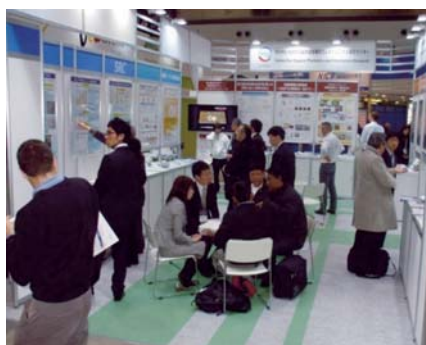


Photo:Exhibition booth

## Joined FC EXPO 2012

OPACK joined the FC Expo 2012 which held at Tokyo Big Sight from Wednesday February 29, through Friday March 2, 2012. The FC Expo is the world's largest fuel cell and hydrogen event where PV EXPO and Battery Japan were jointly held, a total of 93000 people visited during those three days.

At the exhibition venue, the Fukuoka Pavilion Booth was exhibited in collaboration with the Fukuoka Strategy Conference

for Hydrogen energy, the Research Center for Hydrogen Industrial Use and Storage, the Kyushu University International Research Center for Hydrogen Energy and the Hydrogen Energy Test and Research Center. The joint exhibition enabled us to introduce pioneering initiatives for the development of hydrogen energy, an area where Fukuoka has been playing a leading role. OPACK explained agglomeration and operations of research institutions in Academic City by using a panel exhibition, videos, and leaflet distribution. This was a good opportunity to showcase the location environment of Kyushu University Academic City.



Photo:Exhibition booth

## 23rd Town on Campus community design promotion conference hosted

On Monday March 12, 2012, the Town on Campus community design promotion meeting (hereafter referred to as the TOC meeting) at Big Orange on the Ito Campus of Kyushu University, was held. This meeting brought together local residents, people from various sectors including members of Kyushu university, students from home and abroad, people living in the community, and administrative bodies, to exchange ideas and offers opportunity to make use of ideas presented through discussion for future development of Academic City. Under the theme of "Future prospects of Town Development in 2012", the 23rd meeting was held. During the meeting, participants were divided into three groups based on different topics; "Town development", "Cultural exchanges" and "Information transmission." Future courses of action were discussed after exchanging opinions and making presentations on each topic. In addition, a compila-

tion of progress reports on the TOC meeting and Akiya (vacant houses) projects being introduced in Itoshima City were also reported.



Photo:TOC meeting

## Information

### 8th Kyushu University Academic City Information Exchange Seminar held

Under the topic of "Trend in new technologies toward new energy society" OPACK will organize a seminar for the introduction of technologies developed by Kyushu University and ongoing initiatives of Kyushu University Academic City.

Date: Tuesday July 31, 2012

Venue: Hotel Centraza Hakata

Seating capacity:80

For details, please visit our website or contact OPACK.

### Subscribe to our Email Newsletter

OPACK offers e-mail subscriptions which provide a variety of information about events taking place at Kyushu University Academic City, as well as reports on activities carried out by the local government, universities, industry-academia cooperation initiatives and research institutions.

#### Application form procedure

Newsletter subscription application form can be found at <http://www.opack.jp/>



## Introduction of research institutions and corporations located at Kyushu University Academic City

This section will introduce you to research institutions and corporations located at Kyushu University Academic City

### The Research Laboratory High Voltage Electron Microscopy



The Research Laboratory for High Voltage Electron Microscopy, Kyushu University was established in 1975 for researchers and students throughout Kyushu University. Since then, an increasingly wide-range of equipment with new functions has been steadily installed in our laboratory to meet the needs of researchers and society. Today, a total of eight types of microscopes, including the world's only HVEM equipped electron energy analyzer, a variety of sample preparation facilities, and software for analysis are available for use. We will introduce main equipment in our laboratory along with their function and performance.

The lab offers not only the use of equipment, but also study sessions in order to provide and share information about the latest technology, as well as training sessions for fostering enhanced skills of engineers. This equipment and operations are also available to outside users as long as it does not disturb educational and research activities at the university. Since the lab undertook "the Nano-technology Support Project (NSP)" which was initiated in 2002 by the Ministry of Education, Culture, Sports, Science and Technology, our activities have focused on promoting common use of the facilities to outside users from Industry-academia-government organizations, technological consultants, and support for analysis of results. The use of equipment is funded by

tax money, so users must disclose results to the public. However, if outside users from industry would prefer not to disclose results, membership services of High Voltage Electron Microscopy at OPACK are available.

Given that expenses to maintain and administrate our facility are not fully covered by maintenance funding provided by the Ministry, we charge a user-fee for internal users according to the model and the amount of the time spent at laboratory. Additionally, since 2012, we have started to charge outside users for the use of facilities according to instructions issued by the Ministry of Education, Culture, Sports, Science and Technology.

#### Outline of facility

Main facility at the Research Laboratory for High Voltage Electron Microscopy



Eo:1300kV,Ro:0.13nm

#### High Voltage Electron Microscope(JEM-1300NEF)

The world's only HVEM equipped with omega type electron energy analyzer and SDD X-Ray Detector. It also capable of operating observation microscope images, examination of structural elements and analysis of elements, analysis by three-dimensional Electron Tomography, and beam illumination. Such treatments as heating/cooling, (liquid Nitrogen, liquid helium) and tensile stress are also available

#### Aberration corrected transmission electron microscope (JEM-ARM200F)

Atomic resolution electron microscope, equipped with aberration corrections both on illumination-lens and imaging lens. Accelerating voltage for correction at 60, 80,120,200kV. It is also equipped with the world's highest level SDD X-ray detector(solid angle 0.8sr) and electron energy filter(GIF Quantum)



Eo:200kV,Ro:0.11nm



Eo:300kV,Ro:0.26nm

#### Digitized transmission electron microscope (JEM-3200FSK)

It is equipped with a thermal field-emission electron gun, omega — spectrometer and energy-emission X-ray detector. The objective lens incorporates an asymmetrical magnetic lens, enabling dark-field image for observation. Aside from three-dimensional electron tomography (Omni-directional tilt), cooling/heating (liquid Nitrogen, liquid helium) treatment is available.

#### Lorentz electron microscope (TECNAIG2-F20)

Analytical Electron Microscope, equipped with a thermal field-emission electron gun, energy — emission X-ray detector. Its functions are varied, such as observation of STEM image (BF, HAADF), STEM Elemental Mapping, analysis of crystalline materials using three-dimensional electron tomography. It also capable of observing magnetic materials and magnetic domain by Lorentz Transmission Electron Microscopy



Eo:200kV,Ro:0.24nm



### Digital analytical electron Microscopy(TECHNAIG2-20)

Easy-to-use and versatile analytical electron microscope. Aside from conventional electron microscopic observation, it provides STEM elemental mapping, three-dimensional electron tomography and cooling/heating (liquid Nitrogen) function, as well as a specimen holder for in-situ observation.

Eo:200kV,Ro:0.24nm

### Ultra-high-resolution field-emission scanning electron microscope (SII TES + Zeiss-ULTRA55).

Low accelerating voltage scanning electron microscope (Zeiss ULTRA55, accelerating voltage 0.1-30kV) It is equipped with a superconductivity X-ray microcalorimeter for X-ray imaging. It is capable of identifying different types of elements in multi-component substances with the observation of bulk materials surface, element analysis and high resolution X-ray~10eV(at 6keV). Also equipped with a versatile semiconductor SDD detector.



### Nano-probe energy-filtering electron microscope(JEM-2010FEF)

It is equipped with a thermal field-emission electron gun, omega type electron energy analyzer, and an energy-emission X-ray detector. Since maximum accelerating voltage is at 200kV, it is ideal for nano-beam diffraction and convergent-beam electron diffraction.

Eo:200kV,Ro:0.23nm

### Sample preparation facilities

Argon Ion Polishing System (Gatan PIPS Model 691), Dual-Beam (FIB-SEM) Systems for sample processing, (right photo) FEI Quanta 3D 200i, TEM Mill (Fischione M-1050), sample processing device, and other cutting and processing devices.



### High-performance Imaging Plate readout system for TEM use ( DITABIS micron )

Unlike conventional films, the imaging plate technology enables it to digitize data during the reading process and is available directly after readout. There is linearity between the electron irradiation signal and output signal of IP. The plate possesses a large dynamic range of 5 digits so a piece of IP can record images regardless of their intensity.

## High Voltage Electron Microscopy Forum

In collaboration with the Kyushu University High Voltage Electron Microscopy Laboratory, OPACK established the Forum for High Voltage Electron Microscopy for promoting industry-government-academia exchange/collaboration in various fields. Type C members can use various equipment including high voltage electronic microscopes for a maximum of 20 hours a year.

Member's Benefits	Membership of forum		
<p><b>(1) Information Provision</b> The latest news relating to electron microscopes, introduction of technology and products, reports on research</p> <p><b>(2) Consulting</b> Technological consultants related to electron microscope, introduction to researchers and engineers and other operations</p> <p><b>(3) Education &amp; Training</b> Training related to electron microscopes, e-learning, educational materials for remote training, simulators, software for analysis and more</p> <p><b>(4) Research and Technical support</b> Opening various electron microscopes and instructions about the facilities for the public</p>	<p>Membership A ¥200,000/year</p> <p>Information service consulting</p>	<p>Membership B ¥400,000/year</p> <p>Information service consulting</p> <p>+</p> <p>Education/Training support Approximately two courses a year, 2 persons to be admitted to each course</p>	<p>Membership C ¥600,000/year</p> <p>Information service consulting</p> <p>+</p> <p>Education/Training support Approximately two courses a year, 2 persons to be admitted to each course</p> <p>+</p> <p>Research/Technical support Equipment can be used up to 20 hours a year, if exceeded, additional charges will be added</p>

### Contact

Regarding facilities equipped with microscopes

**The Kyushu University High Voltage Electron Microscopy Laboratory**  
744 Motooka Nishi-ku Fukuoka 819-0395 JAPAN  
TEL/FAX:(092)-802-3855 HP:<http://www.hvem.kyushu-u.ac.jp/>

Regarding the Forum for High Voltage Electron Microscopy

**Organization for Promotion Academic City by Kyushu University**  
MJR Kyudai gakken-toshi eki-mae 1F, 105-1 Tokunaga Nishi-ku Fukuoka 819-0375 JAPAN  
TEL:(092)-805-3677 FAX:(092)-805-3678 HP:<http://www.opack.jp/>

### Utilization of ocean renewable energy

#### Background of research

In past twenty years, I have been engaging in research of ocean environments since I moved to the Department of Earth System Science and Technology, which was established in 1990 at Kyushu University. I have been carrying out research on seawater flow in coasts and inland seas, material diffusion and water quality through observation and numerical simulation. Prior to that, I had conducted tank experiments in my specialty of fluid mechanics, one of the research fields of naval architects and ocean engineers. When I started working on research in this area, I came to love field work because I felt that it helped broaden my perspective. During ocean observations, I learned a lot from fishermen who often helped my research and provided useful information about the sea.

Environmental issues of the sea are very complicated because it has been caused by a complex web of factors. However, to me, it seems most ocean researchers are only focused on pursuit of understanding the phenomenon. In practical terms, there has been little effort to come up with specific measures to improve the environment or some might have been even reluctant to admit the reality. Under this circumstance, I came to join the Kyushu University, Department of Energy Science and Engineering in 1998. When I started to research ocean renewable energy, I realized that I could finally tackle the issues that I have long been concerned about. Utilization of ocean renewable energy plays a critical role in addressing environmental issues, so I was ready to start R&D activities on tidal energy generation together with offshore wind power generation. At that time, what I kept in mind most was that R&D activities should not be limited to the laboratory; the real ocean could be another space for my research.

#### Demonstration test of tidal power generation and offshore wind farming in real sea conditions

It is widely known that technology which generates electricity by placing wind turbines or water mills in flows is not new. In recent years, utilization of this traditional technology as a source of producing clean energy is expected to fight against global warming, since it does not release CO<sub>2</sub>. However, obstacles to land-based wind power generation such as noise, scenery, bird strikes make it difficult to build new wind farms. If that is the case, the only option is to find potential sites offshore. In this regard, Japan, a country surrounded by the sea on all sides, can be considered a resource-rich country as it has a 200-nautical-mile exclusive economic zone, which is the sixth largest in the world by landmass. Marine renewable energy is generated by currents, tides, waves, heat, salinity differences, and sea surface wind. In 2005, I lead the project of tidal current power generation by making use of a bridge pier at Ikitsuki Bridge in the Tsuno-Seto Strait of Nagasaki Prefecture, which was conducted as part of the Grant-in-Aid for Scientific Research (KAKENHI) Program. The objectives of this research were to measure the performance of power generators and observe variation of the power by the lunar period. Initially, we only used Darrieus water turbines for modeling this experiment. However, its starting torque was so weak that it could not properly rotate. Then we tested Darrieus and Savonius turbines and managed to rotate it, but found that living creatures in actual sea have considerable influence on operations. As shown in Figure 1, the Savonius turbine's photo taken 17 months after the installation, the surface of turbine covered by many sessile organisms. Results certainly indicated the importance of maintenance in a

real sea environment and we are continuing research for finding solutions to this problem.

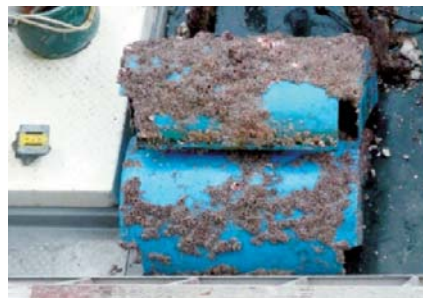


Figure 1. Status of turbine bucket covered by sessile organisms 17 months after installation

As for offshore wind farming, I joined a research group at Kyushu University, which was established in 2003, and mainly worked on research on floating structures. From about 2009, in cooperation with Professor Yuji Ohya of the Kyushu University, Research Institute for Applied Mechanics, I have been involved in research projects toward realization of demonstration tests of offshore wind farming. Figure 2 shows a floating hexagonal structure (18 meters in diameter), which was installed in Hakata Bay on December 2011. The installation was conducted as part of the Kyushu University Wind Lens Project. This project uses wind lens turbines developed by Professor Ohya. Apparently, technology of floating structures has already been in existence for a long time. Combining conventional technology with high performance wind-lens turbines contributed to adding measurable value to the floating structures, making great strides in commercialization of this technology.



Figure 2. A floating structure equipped with offshore wind power generation facilities installed in Hakata bay(December 2011)

#### Future development

The Japanese energy system was forced to change after the Great East Japan Earthquake of March 11, 2011 and subsequent Fukushima nuclear accident. The potential output for marine renewable energy generated by offshore wind farming, current, tide, waves, and heat is estimated to be many times higher than the Japan's total power demand. Based on the results of demonstration tests of large-size floating structure, which is about to kick off, extensive use of marine renewable energy can be realized within several years. Given the harsh natural conditions of a real ocean, continuous feasible study is critical, so that we can make marine renewable energy a reliable energy source.

Yusaku KYOZUKA, Professor of Interdisciplinary Graduate School of Engineering Science, Kyushu University