

JSPS Core-to-Core Program
FY2008 Implementation Plan (Project No. : 18004)

Research Theme Advanced Particle Handling Science
 Duration of Project 2008/4/1 - 2011/3//31 (36 months)
 Core Institution in Japan (Co-Chair) Graduate School of Engineering, Kyoto University
(Ko Higashitani, Specially Assigned Professor)

Implementing Organizations

○ **Japan**

Japan	Core Institution	Graduate School of Engineering, Kyoto University	
	Co-Chair (name and title)	Ko Higashitani, Professor	
	Cooperating Institutions	Graduate School of Pharmaceutical Sciences, Kyoto University Institute for Frontier Medical Sciences, Kyoto University Doshisha University Okayama University University of Hyogo Kobe Gakuin University	Number of Cooperating Institutions 6

○ **Partner Countries**

USA	Core Institution	Particle Engineering Research Center, University of Florida	
	Co-Chair (name and title)	Brij Moudgil, Head of the center, Professor	
	Cooperating Institutions		Number of Cooperating Institutions 0

UK	Core Institution	Institute of Particle Science and Engineering, University of Leeds	
	Co-Chair (name and title)	Simon Biggs, Head of the institute, Professor	
	Cooperating Institutions		Number of Cooperating Institutions 0

Australia	Core Institution	Particulate Fluids Processing Centre, The University of Melbourne	
	Co-Chair (name and title)	Geoff Stevens, Director, Professor	
	Cooperating Institutions		Number of Cooperating Institutions 0

Germany	Core Institution	Institute of Particle Technology, Friedrich-Alexander-University Erlangen-Nuremberg	
	Co-Chair (name and title)	Wolfgang Peukert, Director, Professor	
	Cooperating Institutions	Max Planck Institute for Polymer Research-Mainz (Dr. Hans-Jurgen Butt, Director)	Number of Cooperating Institutions 1

Switzerland	Core Institution	Particle Technology Laboratory, Swiss Federal Institute of Technology Zurich	
	Co-Chair (name and title)	Sotiris E. Pratsinis, Director, Professor	
	Cooperating Institutions		Number of Cooperating Institutions 0

Objectives of Research Exchange (including the five years after the project finishes)

Because of active research exchanges through “face-to-face” contacts among researchers in Universities of Kyoto, Florida, Leeds, and Melbourne, including their alliances, for last two years, the relationship among the participants to this program was strengthened extraordinarily not only between Japanese and partners’ researchers, but also among Japanese researchers beyond their specialties.

Since another three years’ activities are accepted by the JSPS, we expanded the network to cover all the important institutions related with “Advanced Particle Handling Science”, that is, the Particle Institute of Technology in University of Erlangen, Germany, the Polymer Physics Group in Max Planck Institute-Mainz, Germany and the Particle Technology Laboratory in Swiss Federal Institute of Technology Zurich joined into our network.

In FY2008, the collaboration researches are expanded from four to six topics between Japanese and partners’ researchers, and seven seminars are planned. As for researcher exchanges, we will send especially the young Japanese researchers to all the partner institutions in order to establish a highly individual network for next generation via the scientific meetings and information exchanges there.

Now we established the Project Division of Particle Science and Technology within Advanced Engineering Research Center, at Katsura Int’tech Center, Graduate School of Engineering, Kyoto University. This organization, which is composed of 58 members; researchers from Kyoto Univ (Chemical Eng., Polymer Chemistry, Aeronautics Eng., Mechanical Eng., Pharmaceutical and Tissue Eng.), Okayama Univ, Univ. Hyogo, Doshisha Univ, Kobe Gakuin Univ. and active individual researchers, will promote various activities to establish the fundamentals and applications of particle handling science and technology.

Various researches related with micron-size and nano-size particles, such as the researches to solve the problems in production processes of highly functionalized particles and the problems arising from the release of nano-particles to the environment will be strongly promoted through the collaborations between Japanese researchers and partner institutes. At the same time, active seminars and research exchanges will be promoted, aiming to make this project division as the core institute of particle science and technology not only in Japan but also in the world.

Results to the present

For last two years, 4 research collaborations, 16 seminars, and the 7 researcher exchanges were carried out as scheduled, except the 2nd seminar in 2006 which was cancelled because of sickness.

The collaborations were expanded from 4 projects to 6 projects. This expansion arose from “face-to-face” contacts between young researchers. These researches are carried out in such a way that the Japanese researchers visit their collaborating institutes, exchange their scientific ideas and sometimes perform the experiments with the collaborators to obtain fruitful results.

As for the research exchange, so far 34 researchers visited us from abroad to give their talks at the Core-to-Core seminars in Kyoto University and the alliance universities. The seminars were held 16 times for two years with those visiting researchers, where 453 researchers and students participated to exchange their up-to-date information.

We sent 58 Japanese researchers, mainly young researchers, to the partner institutions (12 to the University of Leeds, 12 to the University of Melbourne, 7 to University of Florida, 5 to the Max Planck Institute, 3 to the Swiss Federal Institute of Technology), and established strong networks between individuals via the scientific meetings held at the partner institutes.

Summary of FY 2008 Exchange Plan

Joint Research

Three projects (Project #1~#3) have been continued from last year. One of the collaboration project “Development of CN tip coated by gold nano particles: B.Moudgil (Florida Univ.) – K.Higashitani (Kyoto Univ.)” was terminated, because we got the concluding data to publish. In FY 2008 young researchers start aggressively new collaboration projects (Project #4~#6) through their “face-to-face” contacts for last two years. We are expecting a few more collaborations will come out in the future.

(1) Electro-Hydrodynamics Phenomena of Charged Particles (Kyoto-Leeds)

Using a novel computational technique developed in the simulation group of Kyoto University, the above phenomena relevant to the particle handling are simulated with the help of the experimental group of University of Leeds.

(2) Measurement and Control of Electrostatic Particle Charging (Kyoto-Leeds)

In this project, the process of charge transfer/saturation by the collision between particle and wall, the measuring methods for the amount of charges of individual particles, and the corresponding on-line measurement technique for charge amount and charge transfer are investigated.

(3) Development of Gadolinium-containing Nanoparticles Applicable for Diagnosis and Neutron-Capture Therapy of Cancer (Kobe Gakuin-Florida)

This project aims at development of tumor-accumulative nano-particles with gadolinium for cancer therapy and fluorescent substances for optical imaging. These nano-particles are synthesized using the liquid-phase template technique at University of Florida. Then, their movement in model animals with tumor is investigated at Kobe Gakuin University.

(4) Colloidal crystal structures (Kyoto-Florida)

Crystal formation processes of nano-particles are investigated by a comparison between the experimental results at University of Florida and the computer simulation results at Kyoto University, aiming at elucidation and modeling of the phenomena.

(5) Dry separation process by fluidized bed (Okayama - Melbourne)

A method to separate solid materials by their characteristics by using the fluidized bed was developed by Okayama University. Now this method is applied to separate coals in the coal mining process in Australia (University of Melbourne)

(6) Interaction of particles with molecular layers at the air-water interface (Shinshu–Max Planck Institute)

The method developed while Dr. McNamee (Shinshu Univ) was in Max Planck Institute will be further developed in Max Planck Institute to know the interaction of particles with molecular layers at the air-water interface.

Seminar

Nine seminars (17th-25th seminars) are planned to be held in 2008, with the aim of bringing the researchers together and exchanging the up-to-date information, which are relevant to the establishment of the strong cooperating system.

- (1) The heads or leaders of three partner institutions and the world-famous researchers come to exchange the information and to give seven following seminars, although some of them are not decided completely yet.: 17th, J.Elliott (Cambridge, UK); 19h, W.Ducker (Melbourne), M.Borkovec(Geneva, Switzerland), & M.Elimelech(Yale, US); 20th, S.Pratsinis (EHT); 21th, D.Dupin (Sheffield, UK); 22th S.Onishi (South Australia); 23th, J.N.Israelachvili (California, Santa Babara); 25th, M.Ghadiri (Leeds). These distinguished professors mainly come from six partner institutions or the related institutions.
- (2) In 24th seminar, which is called “Young Researchers’ Meeting”, more than 20 young researches camp together to make an intimate correlation. This year it will be held under the guidance of Prof. Peukert at both the University of Erlangen and Max Planck Institute. 14 Japanese researchers will attend the meeting. It is expected that many young researchers from six partner institutions will also come to participate to this meeting held at the center of Europe. This meeting enables the young researchers to exchange the up-to-date information and to establish the strong network for their future.
- (3) In 25th seminar, not only the seminar by three speakers but also the general meetings are held to summarize the activities in 2008.

Researcher Exchanges

Because more than 10 researchers came from our partner institutions to Japan, this year, not too many researchers, may be 3 or 4, will come from our partner institutions, but fortunately many world-famous researchers will contribute to this Core-to-Core seminar as described above. Japanese researchers will be sent to the partner institutes as follows.

- (1) University of Leeds: 5 researchers.
- (2) University of Florida: 8 researchers.
- (3) University of Melbourne: 5 researchers.
- (4) Max-Planck Institute, Erlangen University: 14 researchers.
- (5) ETH: 5 researchers.