

JSPS Core-to-Core Program FY2010 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, Specially Assigned Professor	
	Cooperating Institutions	Innovative Collaboration Center, Kyoto University Graduate School of Pharmaceutical Sciences, Kyoto University Institute for Frontier Medical Sciences, Kyoto University Institute for Integrated Cell-Material Sciences, Kyoto University Doshisha University Faculty of Science and Engineering Doshisha University Graduate School of Engineering Graduate School of Natural Science and Technology, Okayama University Faculty of Pharmaceutical Sciences, Kobe Gakuin University Graduate School of Engineering, University of Hyogo	Number of Cooperating Institutions 9

○ **Partner Countries**

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

United Kingdom	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	0	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	Curtin University	Number of Cooperating Institutions 1

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	0	Number of Cooperating Institutions 0

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

The research of Particle Technology in Japan has 50 years' history, in such a way that laboratories in Department of Chemical Engineering of Kyoto University have been the leading institution. Three well-organized institutions on Particle Technology, which are all our partner institutions in the present program, were established after 1995, by being detonated not only by knowing the importance of Particle technology, but also by the activities in Japan. In Germany, a well-equipped institution on Particle Technology was established in 2003.

On the other hand, although there are many active laboratories on Particle Technology in Japan, no effective and well-organized institution exists as in abroad. In order to keep leading the researches on particle technology, it is inevitable to have some centers connecting the active laboratories in Japan closely and inter-disciplinary.

Based on the strong international and domestic networks established through many scientific meetings, joint research activities, researcher exchanges and visits to Core institutions and cooperating institutions during the program "Integrated Action Initiatives" for the first two years, an effective, inter-disciplinary integrated Division of Advanced Particle Science and Technology was established within Advanced Engineering Research Center in the Graduate School of Engineering, Kyoto University, beyond the walls of faculties in Kyoto University and the other universities. This division is acting as the headquarters to strengthen the world-wide network more strongly and to make the members lead the world research on Particle Technology. This activity will reflect to make the education in Kyoto University higher through the system of Advanced Engineering Education Center. Finally, it is hoped that the division will be one of the advanced centers of Particle Technology not only in Japan but also in the world.

Results to the present

As it was aimed, when this program was elevated from “Integrated Action Initiatives” to “Strategic Research Networks” in 2008, the inter-disciplinary Division of Advanced Particle Science and Technology was established within Advanced Engineering Research Center in the Graduate School of Engineering, Kyoto University. Through this headquarters of the program, the networks of Japanese members and the members of 6 well-established partner institutions (University of Leeds, Florida, Melbourne, Erlangen, and Swiss Federal Institute of Technology Zurich, and MaxPlanck Institute, Mainz) were strengthened extensively.

In 2009, 13 international joint research activities are continuing from last year, and 7 collaboration projects were newly proposed by young researchers. In addition, 12 domestic joint research activities, including 4 newly proposed ones, are proceeding among Japanese researchers. Many results derived from these collaborations were published as research papers in various international journals.

As for the seminars in 2009, 10 seminars had been planned and all the seminars were carried out, as scheduled, to exchange the up-to-date information. This means that 36 seminars were held for 4 years, inviting 60 speakers from abroad.

As for the visits of Japanese members to the partner institutions in 2009, 46 members in total visited the partner institutions, and through their compulsory oral presentations there, the members not only exchanged the research information but also were internationalized greatly. 172 Japanese members visited the partner institutions for 4 years.

Last year, the “Core-to-Core Young Researchers Meeting” was held for 4 days in the city of York and in University of Leeds in United Kingdom, where 48 young researchers from Universities of Leeds, Melbourne, Erlangen and Max Planck Institute and also from Japan got together and made their active discussions. This Young Researchers’ Meeting has been taken over successfully from Kyoto University in 2006, University of Melbourne in 2007, University of Erlangen and Max Planck Institute in 2008 to University of Leeds, last year. This year, we are planning to have the final “Young Researchers’ Meeting” of 4 days in Kyoto, inviting the organizers of the partner institutions, in order to summarize our activities for five years of this program among Japanese and partner institutions.

Summary of FY 2010 Exchange Plan

Joint Research

13 international (Project #1~#13) and 8 domestic collaboration projects (Project #21~#28) are continuing from last year. In 2009, young researchers started newly 7 international (Project #14~#20) and 4 domestic collaboration projects (Project #21~#32), as shown below.

● Continuing International Collaboration Projects

(1) Measurement and Application of Charged Particles

S. Matsusaka (Kyoto Univ.)-M.Ghadiri (Univ. of Leeds)

(2) Development of Gadolinium-containing Nanoparticles Applicable for Diagnosis and Neutron-capture Therapy of Cancer

H. Ichikawa (Kobe Gakuin Univ.)-B. Moudgil and P. Sharma (Univ. of Florida)

(3) Mechanism Clarification of Colloidal Crystal Formation Processes

S. Watanabe (Kyoto Univ.)-P.Jiang (Univ. of Florida)

(4) Dry Mineral Processing Using Gas-solid Fluidized Bed

J. Oshitani (Okayama Univ.)-G. Francs (Univ. of Melbourne)

(5) Study on Contact Angle of Polymer Particles on Interfaces

S. Fujii (Osaka Institute of Tech.)-H. Butt and M. Keppel (Max Planck Institute)

(6) Fabrication of Inorganic Nanofibers and its Application to Nanofluid Technology

S. Nagamine (Kyoto Univ.)-Y. Ding (Univ. of Leeds)

(7) Temperature Responsive Polymers as Functional Flocculants

N. Ishida (AIST) - G. Franks (Univ. of Melbourne)

(8) Development of Novel Multiple-Stimuli Responsible Particle as Functional Material

N. Ishida (AIST) - S. Biggs (Univ. of Leeds)

(9) Development of Wet Dispersion Method of Nano-order Particles

K. Gotoh (Okayama Univ.)- W. Peukert (Univ. of Erlangen)

(10) Interaction of particles with Molecular Layers at the Air-water Interface

C. McNamee (Shinshu Univ.)-K. Higashitani (Kyoto Univ.)- H. Butt & M. Kappl (Max Planck Institute)- D. Chan (Univ. of Melbourne)

(11) Self-assembly of Nanoparticle and its Application

K. Sugano (Kyoto Univ.)- W. Peukert (Univ. of Erlangen)

(12) Lattice Boltzmann Simulations of Wetting on Solid Surfaces

H. Shinto (Kyoto Univ.)- Y. Ding (Univ. of Leeds)

(13) Rheological Properties of Coagulated Colloidal Suspensions

Y. Adachi (Tsukuba Univ.)- P. Scales (Univ. of Melbourne)

Joint Research

●New International Collaboration Projects

- (14) **Mechanochemical Modification of Organic Particles for Pharmaceutical Applications**
Y. Shirakawa (Doshisha Univ.)- S. Brown (Univ. of Florida)
- (15) **Controlling Dry powder Flowability by Designing Surface Functional Groups**
M. Yoshida (Okayama Univ.)- W. Peukert (Friedrich-Alexander-University
Erlangen-Nuremberg)
- (16) **Study on Evaporation Behavior from Particle-stabilized Water Droplets**
S. Fujii (Osaka Institute of Tech.)- H. Butt and M. Keppel (Max Planck Institute)
- (17) **Synthesis of Porous Polymer Capsules**
S. Fujii (Osaka Institute of Tech.)- S. Biggs (Univ. of Leeds)
- (18) **Surface Characterization of Nanoparticles Carrying pH-Responsive Polymer Hair**
S. Fujii (Osaka Institute of Tech.)- S. Biggs (Univ. of Leeds)
- (19) **Study on the Dependence of the Temperature Distribution of the Flame on the Nano-particle Formation**
K. Tanoue (Yamaguchi Univ.)- W.J. Stark (Swiss Federal Institute of Technology)
- (20) **Creation and Investigation of Polysaccharide Modified Surfaces**
C. McNamee (Shinshu Univ.)- D. Suzuki (Shinshu Univ.)- K. Higashitani (Kyoto Univ.)-
H. Butt and M. Kappl (Max Planck Institute)

●Continuing Domestic Collaboration Projects

- (21) **Effects of Solutions on the Friction and Wear of Particle Surfaces**
K. Higashitani (Kyoto Univ.)-C. McNamee (Shinshu Univ.)
- (22) **Mechanism of Shape Formation of Nano Particles Synthesized in Solutions**
S. Watanabe (Kyoto Univ.)-S. Morisada (Tokyo Institute of Tech.)
- (23) **Development of Transportation System of Hydrophobic Drugs of Oil Droplet Type**
K. Imamura (Okayama Univ.) – J. Oshitani (Okayama Univ.)
- (24) **AFM Measurements and Simulation of Pickering Emulsions and Particles**
S. Fujii (Osaka Institute of Tech.)-H. Shinto (Kyoto Univ.)
- (25) **Interaction between Micro-Organisms and Particles**
T. Nomura (Osaka Prefecture Univ.) - H. Shinto (Kyoto Univ.)
- (26) **Simultaneous Measurements of Cells with GFP using AFM and TIRFM**
K. Hori (Nagoya Institute of Tech.) - H. Shinto (Kyoto Univ.)
- (27) **Application of QCM-D and AFM to the Biological Systems**
N. Ishida (AIST) - H. Shinto (Kyoto Univ.)
- (28) **Molecular Simulation using Implicit Solvent Mode**
S. Morisada (Tokyo Institute of Tech.) - H. Shinto (Kyoto Univ.)

Joint Research

●New Domestic Collaboration Projects

(29) Interactions between Particles and Living Cells

H. Ichikawa (Kobe Gakuin Univ.)- H. Shinto (Kyoto Univ.)

(30) Formation of Composite Particles by Spray Crystallization Method

Y. Shirakawa (Doshisha Univ.)- H.Ichikawa (Kobe Gakuin Univ.)

(31) Nanostructural Evaluation of Surface-Grafted Stimuli-Responsive Polymers by Ellipsometry

N. Ishida (AIST) – K.Imamura (Okayama Univ.)

(32) Kinematic Study of Physical Perception of Powdered, Particulate and Liquid-Dispersed Systems

K. Kurumada (Fukushima National College of Technology) - K.Ashraf (Yokohama National Univ.)-K. Goto and M. Yoshida (Osaka Prefecture Univ.)

Seminar

Most seminars of this year will be held in Kyoto University-Katsura Campus, as in the case of last 4 years. 7 seminars are planned to be held, inviting the active researchers from abroad. One of the seminars is “Young Researchers’ Meeting”, in which young researches camp together to make their intimate networks. Each year, this meeting has been taken care of not only by Kyoto University but also by partner institutions in turn, and all meetings so far are extremely successful and evaluated very high by all the coordinators of partner institutions. This year, because of the last year of this program, the meeting will be held in Kyoto, inviting not only young researchers but also established professors and coordinators from partner institutions in order to summarize the activities of this program of 5 years.

Researcher Exchanges

The information exchange among researchers is, of course, possible through their collaboration works and seminars in Japan, but it is also extremely important for Japanese researchers to experience directly what is going on in the partner institutions and to have a small seminar there to know each other personally. The plan to visit partner institutions this year is shown below, although the concrete date is not fixed yet because of the partners’ circumstances. The plan is scheduled such that the visit date of researcher exchange and the collaboration period of research collaborators in the partner institutions overlap each other to make this seminar more fruitful and also to save the expenses and time. In this program, it is compulsory to have a seminar in the partner institutions.