

Priority Area:

6. Surface and Interface Science, including Catalysis

Coordinators:

(Japanese)

Yasuhiro Iwasawa

Professor

Graduate School of Science

University of Tokyo

(Indian)

Milan Kumar Sanyal

Head, Surface Physics Division

Saha Institute of Nuclear Physics

India-Japan Cooperative Science Programme
Activity Report in the Area: Surface and Interface Science, including Catalysis

Overview and Future Plan

1.FY2002 Overview

Prof. Y. Iwasawa and Prof. M. Sanyal initiated the activity for a new research area " Surface and Interface Including Catalysis" since August, 2002. As the first event the First JSPS-DST Symposium on Surfaces and Interfaces for Nanostructured Materials was organized by Prof. Iwasawa. The symposium which constituted invited lectures by eight Indian scientists and twelve Japanese scientists, and five contributed papers, provided great potentials to guarantee sustainable human life by creating novel nanostructured materials and efficient functions on the basis of new concepts and principles. Further, Indian scientists and Japanese scientists had much significant time for discussion on their interests during the Symposium as well as at Universities and Institutes in Japan where they visited.

2.FY2003-2004 Future Plan

Both Indian and Japanese sides have knew what the event can produce, but in deed the Symposium has recognized again that it is really flourishing exchange program. Thus, Prof. Y. Iwasawa and Prof. M. Sanyal have decided that the second DST-JSPS Symposium on Surfaces and Interfaces for Nanostructured Materials will be organized in India in FY2003. In addition to the organization of the Symposium, selected joint research programs will start from FY2003. The detail of the joint research programs will be decided after discussion between the two Coordinators of India and Japan.

3.Summary

Discovery of novel physical and chemical phenomena, New concepts, Creation of new nanomaterials, Nano-properties and mechanisms at surfaces, new surface characterization techniques for nanomaterials, new theory and simulation for nanomaterials, and so on were presented and brought into the discussion in the Symposium. There were lots of chance to talk about their mutual interests, which may expect to produce further progress in their researches as well as new extension to collaborative researches.

Modes of Cooperation:

1. Joint Research Projects
2. Seminars
3. Visiting Scientists for Information Exchange

Report

1. Joint Research Project

FY2002

Project No.1

Title:

Objectives:

Project Coordinators:

(Japanese)

Yasuhiro Iwasawa

Professor

The University of Tokyo

(Indian)

Milan Kumar Sanyal

Professor

Saha Institute of Nuclear Physics

Date of Commencement:

Date of Completion:

Accomplishment Status:

Future Plan:

To achieve design and development of nanomaterials demands collaboration and cooperation of scientists in different research fields, which leads to innovative sciences and technologies. Joint Research Projects for FY2003 and FY2004 were discussed at the JSPS-DST Symposium on Surfaces and Interfaces for Nanostructured Materials, Tokyo, March 25-27, 2003. Several Projects were proposed in the area of Surface and Interface Science, including Catalysis. Their details are under consideration at moment, but will be decided by Prof. Y. Iwasawa and Prof. M. Sanyal.

FY2003

Project No.1

Title: Surfaces and Interfaces for Nanostructured Materials

Project Coordinators:

(Japanese)

Yasuhiro Iwasawa

Professor

The University of Tokyo

(Indian)

Milan Kumar Sanyal

Professor

Saha Institute of Nuclear Physics

Date of Commencement: 1 April 2003

Date of Completion: 31 March 2005

Research Plan:

(1) Low Dimensional Magnetism in Nanostructured Organic Materials

(a) Preparation of molecular magnets by Langmuir-Blodgett and other techniques. The magnetic clusters will be embedded in organic matrix and the size of the clusters will vary from single ion to few nanometer diameter particles.

(b) Sample preparation and initial SPM/X-ray characterization will be done in India. We shall also perform initial magnetization measurements down to 4K.

(c) STM measurements with and without magnetic field, DC/AC magnetization measurements of these extremely diluted magnetic systems down to millikelvin temperature, and EXAFS (polarized), MCD and MOKE measurements in low temperatures with and without high magnetic field will be done in Japan.

(d) Data interpretation, to be carried out both in India and Japan.

(2) Nanostructures and Catalysis at Surfaces and in Nanospaces

(a) Design and catalytic performance of novel mixed metal-oxide nanostructures.

(b) Design and performance of novel molecular imprinting catalysts.

These studies will be made in both Japan and India through exchange of scientists and samples.

(3) 2nd JSPS-DST workshop will be scheduled to discuss intensively on surfaces and interfaces for nanostructured materials in December, India.

2. Seminar

FY2002

Seminar No.1

Title: JSPS-DST Symposium on Surfaces and Interfaces for Nanostructured Materials

Objectives:

The Symposium was aimed to discuss intensively on the important topics on surfaces and interfaces for nanomaterials which provide great potentials to guarantee sustainable human life by creating novel nanostructured materials and efficient functions on the basis of new concepts and principles.

Seminar Coordinators:

(Japanese)

Yasuhiro Iwasawa

Professor

The University of Tokyo

(Indian)

Milan Kumar Sanyal

Professor

Saha Institute of Nuclear Physics

Period: 25 March 2003 - 27 March 2003**Place:** Tokyo**Accomplishment Status:**

Subjects in the Symposium were focused on nanostructures and catalysis at surfaces, material design in nanospaces, nanostructures and devices at semiconductor surfaces, characterization of structures and electronic states at surfaces, nanomaterials for advanced fuel cells, theory and simulation, etc. Discovery of novel physical and chemical phenomena, new concepts, creation of new nanomaterials, nano-properties and mechanisms at surfaces, new surface characterization techniques for nanomaterials, new theory and simulation for nanomaterials, were exchanged at the Symposium.

Programme**March 25, Tuesday****Opening**

9:30-9:35 Opening remarks by Prof. Iwasawa (Japanese Coordinator)

9:35-9:40 Opening remarks by Prof. Sanyal (Indian Coordinator)

Lectures9:40-10:20 M. Sanyal(Saha (Saha Institute of Nuclear Physics, Calcutta)
" Low Dimensional Physics in Nanometer-thick Organic Films "10:20-10:35 *Coffee Break*10:35-11:05 Y. Iwasawa (The University of Tokyo, Tokyo)
" Dynamic Nanomaterials at Surfaces: Design, Structure, and Catalysis"11:05-11:45 B.M. Choudary(Indian Institute of Chemical Technology, Hyderabad)
" Nanopalladium Induced C-C Coupling Reactions: The Mechanistic Insight "11:45-13:30 *Lunch*13:30-14:00 T. Ogino and Y. Homma (Yokohama National University; Yokohama; NTT
Corporation, Atsugi)

" Control of Nanostructure Self-assembly for Nano-integrated Systems "

14:00-14:30 Y. Okamoto (Shimane University, Shimane)
" Preparation and Catalysis of Intrazeolite Cobalt-Molybdenum Sulfide Clusters "14:30-15:10 T. Pradeep (Indian Institute of Technology, Madras)
" Monolayer Protected Metal Clusters; Chemical Properties "15:10-15:25 *Coffee Break*

15:25-15:55 K. Asakura (Hokkaido University, Sapporo)

- 15:25-15:55 " Polarization-dependent XAFS Studies on Nano-structures on Oxides "
H. Aizawa, Y. Morikawa, S. Tsuneyuki, K. Fukutani, and T. Ohno (National Institute for Materials Science; National Institute of Advanced Industrial Science and Technology; Graduate School of Science, The University of Tokyo; Institute of Industrial Science)
- 15:55-16:25 " Computational Analysis of the Anomalous Vibrational Spectra of NO/Pt (111) "
Y. Morikawa, H. Ishii, and K. Seki (Research Institute for Computational Sciences; National Institute of Advanced Industrial Science and Technology)
- 18:00 - 20:30 (tentative) " Theoretical Study of n-Alkane and Metal Surface Interaction "
Welcome Dinner hosted by Mr. Tandon, Indian Embassy

March 26, Wednesday

- 9:30-10:10 A. Sharma (Indian Institute of Technology, Kanpur)
" Self-organized Patterns in Controlled Films: from Newtonian Liquids to Soft Solids "
- 10:10-10:40 T. Yamase (Tokyo Institute of Technology, Yokohama)
" UV-induced Formation of Nano-sized Polyoxomolybdate Clusters in Aqueous Solutions"
- 10:40-10:55 *Coffee Break*
- 10:55-11:25 T. Imae (Nagoya University, Nagoya)
" Formation of patterned Dendrimer Self-assembled Monolayer and Selective Adsorption/ Desorption Behavior on It "
- 11:25-12:05 A. B. Mandal (Central Leather Research Institute, India)
" How Much We Know about Self-aggregated Systems "
- 12:05-13:30 *Lunch*
- 13:30-14:00 K. Prabhakaran (NTT Basic Research Laboratories, Atsugi)
" Nanoparticles as Potential Candidates for " Bottom-Up" Approach ? "
- 14:00-14:40 G. U. Kulkarni (Jawaharlal Nehru Centre for Advanced Scientific Research, India)
"Metal Nanocrystals: Size-dependent Properties, Mesoscopic Assemblies and Nanolithography "
- 14:40-14:55 *Coffee Break*
- 14:55-15:25 M. Ichikawa (Hokkaido University, Sapporo)
" Templating Synthesis of Nano-metal Particles and Wires in Mesopores and Their Unique Catalysis "
- 15:25-15:55 T. Murata and M. Suemitsu (Tohoku University, Sendai)
" Initial Adsorption of GeH₄ at Si(001): H Transfer and Site Exchange Between Si and Ge"
- 15:55-16:25 C. Oshima (Waseda University, Tokyo)
" Noble Boron-Carbon Films on NbB₂ (0001) Surface "

March 27, Wednesday

- 9:30-10:00 J. Mizuki (Japan Atomic Energy Research Institute, Spring8, Hyogo)
" Structural Study on Catalyst for Automotive Emission Control Using X-ray Anomalous Effect "

10:00-10:30	G. Ranga Rao (Indian Institute of Technology, Chennai) " Rare Earth Overlayers and Oxide Nanoparticles for Catalytic Studies "
10:30-10:45	<i>Coffee Break</i>
10:45-11:15	M. Tsukada (The University of Tokyo, Tokyo) " Theory of Quantum Transport of Atomic and Molecular Bridges "
11:15-11:55	D. Sen (Indian Institute of Science, India " Studies of the Conductance of Quantum Wires "
11:55-13:30	<i>Lunch</i>
13:30-14:00	A. Fujimori (The University of Tokyo, Kashiwa) " Photoemission Spectroscopy of Novel Ferromagnetic Semiconductors in Thin Films and Interfaces"
14:00-14:40	K. Maiti (Tata Institute of Fundamental Research, India) " Study of the Electronic Properties of Gd using Photoelectron Spectroscopy "
14:40-15:10	T. Ohta (The University of Tokyo, Tokyo) " Surface Structures and Magnetic Properties Studied by Core Excitation Spectroscopy "
15:10-15:25	<i>Coffee Break</i>
15:25-16:25	Future Plan for JSPS-DST Program
16:25-16:30	Closing Remarks

List of Participants

From Japan:

Yasuhiro Iwasawa	Professor, Graduate School of Science, The University of Tokyo
Atsushi Tsukada	Professor, Graduate School of Science, The University of Tokyo
Chuhei Oshima	Professor, Faculty of Science and Engineering, Waseda University
Toshio Ogino	Professor, Faculty of Engineering, Yokohama National University
Yasuaki Okamoto	Professor, Interdisciplinary Faculty of Science and Engineering, Shimane University
Toshihiro Yamase	Professor, Chemical Resources Laboratory, Tokyo Institute of Technology
Kiyotaka Asakura	Professor, Catalysis Research Center, Hokkaido University
Masaru Ichikawa	Professor, Catalysis Research Center, Hokkaido University
Junichiro Mizuki	Deputy Head, Japan Atomic Energy Research Institute
Toshiaki Ota	Professor, Graduate School of Science, The University of Tokyo
Atsushi Fujimori	Professor, Graduate School of Frontier Sciences, The University of Tokyo
Toyoko Imaei	Professor, Research Center for Materials Science, Nagoya University

From India:

Milan Kumar Sanyal	Professor, Surface Physics Division, Saha Institute of Nuclear Physics,
Asit Baran Mandal	Professor, Physical and Inorganic Chemistry Division, Central Leather Research Institute, Chennai
Boyapati Manoranjan Choudary	Deputy Director, Indian Institute of Chemical Technology, Hyderabad
Pradeep Thalappil	Associate Professor, Indian Institute of Technology, Chennai
Ashutosh Sharma	Professor, Indian Institute of Technology, Kanpur
Kalobaran Maiti	Scientist E, Tata Institute of Fundamental Research, Mumbai
Giridhar Kulkarni	Associate Professor, Jawaharlal Nehru Centre for Advanced Scientific

Diptiman Sen

Research
Associate Professor, Indian Institute of Science, Bangalore

FY2003

Seminar No.1

Title: JSPS-DST Symposium on Surfaces and Interfaces for Nanostructured Materials

Purpose and Contents:

The Symposium is aimed to discuss intensively on the important topics on surfaces and interfaces for nanomaterials which provide great potentials to guarantee sustainable human life by creating novel nanostructured materials and efficient functions on the basis of new concepts and principles. To achieve design and development of nanomaterials demand the collaboration and cooperation of scientists in different research fields, which leads to innovative sciences and technologies. Subjects in the Symposium are focused on surfaces and interfaces for nanostructured materials following the first JSPS-DST Symposium which was held on 25-27 March 2003, Tokyo.

Seminar Coordinators:

(Japanese)

Yasuhiro Iwasawa

Professor

The University of Tokyo

(Indian)

Milan Kumar Sanyal

Professor

Saha Institute of Nuclear Physics

Period: 10 December 2003 - 12 December 2003

Place: India

Expected Effects:

Discovery of novel physical and chemical phenomena, new concepts, creation of new nanomaterials, nano-properties and mechanisms at surfaces, new surface characterization techniques for nanomaterials, new theory and simulation for nanomaterials, and so on are expected by the Symposium.

Further, this symposium will contribute to extension of scientific exchange between Japan and India to higher level achievements.

List of Participants

From Japan:

Yasuhiro Iwasawa	Professor, Graduate School of Science, The University of Tokyo
Atsushi Tsukada	Professor, Graduate School of Science, The University of Tokyo
Chuhei Oshima	Professor, Faculty of Science and Engineering, Waseda University
Toshio Ogino	Professor, Faculty of Engineering, Yokohama National University
Yasuaki Okamoto	Professor, Faculty of Fundamental Engineering, Shimane University
Toshihiro Yamase	Professor, Institute of Resources and Chemistry, Tokyo Institute of Technology
Kiyotaka Asakura	Professor, Catalysis Research Center, Hokkaido University
Masaru Ichikawa	Professor, Catalysis Research Center, Hokkaido University
Junichiro Mizuki	Deputy Head, Japan Atomic Energy Research Institute
Toshiaki Ota	Professor, Graduate School of Science, The University of Tokyo
Atsushi Fujimori	Professor, Graduate School of Frontier Sciences, The University of Tokyo
Toyoko Imaei	Professor, Research Center for Materials Science, Nagoya University
Fumiko Komori	Associate Professor, Institute of Solid State Physics, The University of Tokyo

From India:

Milan Kumar Sanyal	Professor, Surface Physics Division, Saha Institute of Nuclear Physics,
Asit Baran Mandal	Professor, Physical and Inorganic Chemistry Division, Central Leather Research Institute, Chennai
Paul Ratnasamy	Professor, National Chemical Laboratory, Pune
Boyapati Manoranjan Choudary	Deputy Director, Indian Institute of Chemical Technology, Hyderabad
Pradeep Thalappil	Associate Professor, Indian Institute of Technology, Chennai
Ashutosh Sharma	Professor, Indian Institute of Technology, Kanpur
Kalobaran Maiti	Scientist E, Tata Institute of Fundamental Research, Mumbai
Giridhar Kulkarni	Associate Professor, Jawaharlal Nehru Centre for Advanced Scientific Research
Diptiman Sen	Professor, Indian Institute of Science, Bangalore