ACTIVITIES OF JOINT USAGE/RESEARCH CENTER

JURC Cooperative Research Subjects 2014

(1 April 2014 ~ 31 March 2015)

STARTING-UP SUBJECTS
(IN SPECIFIC FIELDS CHOSEN BY JURC)

Neutron Imaging with Small Pulse Neutron Source
OTAKE, Yoshie, Riken Center for Advanced Photonics
Host in JURC IWASHITA, Yoshihisa

Diagnostics of Li-Ion Batteries with Laser-Accelerated Protons
KATO, Yoshiaki, The Graduate School for the Creation of New Photonics Industries
Host in JURC SAKABE, Shuji

Mechanistic Study for Homogeneous Catalytic Hydrogenation of Unsaturated Hydrocarbons by Fe and Ru Complexes Having Disilametallacycle Fragments: The Role of Silane–Ligand toward H_2 Activation
TAHARA, Atsushi, Institute for Materials Chemistry and Engineering (IMCE), Kyushu University
Host in JURC OZAWA, Fumiyuki

Development of Transition-Metal Catalysts Ligated by Silyl-Perturbed Low-Coordinated Phosphines
ITO, Shigekazu, Graduate School of Science and Engineering, Tokyo Institute of Technology
Host in JURC OZAWA, Fumiyuki

Characterization of Self-assembled Peptides on Two-dimensional Semiconductor Nanomaterials by Microscopic Photoluminescence Lifetime Measurements
HAYAMIZU, Yuhei, Graduate School of Engineering, Tokyo Institute of Techonology
Host in JURC KANEMITSU, Yoshihiko

Study for Dynamical Screening in Carbon Nanotubes and Quantum Wires
SUZUURA, Hidekatsu, Graduate School of Engineering, Hokkaido University
Host in JURC KANEMITSU, Yoshihiko

Development of Gold Nanoparticle 2D-Arrays for Plasmon-Enhanced Photochemical Reactions
MIKI, Kazushi, Polymer Materials Unit, National Institute for Materials Science
Host in JURC ISOZAKI, Katsuhiro

Analysis and Control of Complex Bipartite Networks
NACHER, C. Jose, Department of Science, Toho University
Host in JURC AKUTSU, Tatsuya

Probabilistic Methods for Analysis on Protein Interaction Networks
MARUYAMA, Osamu, Institute of Mathematics for Industry, Kyushu University
Host in JURC AKUTSU, Tatsuya

Pathway Database for Human Gut Microbiome
YAMADA, Takuji, Graduate School of Bioscience and Biotechnology, Tokyo Institute of Technology
Host in JURC GOTO, Susumu

Bioinformatics with Auxiliary Biological Knowledge
SHIGA, Motoki, Informatics Course, Department of Electrical, Electronic and Computer Engineering, Faculty of Engineering, Gifu University
Host in JURC MAMITSUKA, Hiroshi

Knowledge Discovery from Life-Science Data with Discrete Structures
TAKIGAWA, Ichigaku, Graduate School of Information Science and Technology, Hokkaido University
Host in JURC MAMITSUKA, Hiroshi

Selective Chemical Modification of Biomolecules in Membrane by Functionalized Catalysts
KUNISHIMA, Munetaka, Faculty of Pharmaceutical Sciences, Institute of Medical, Pharmaceutical, and Health Sciences, Kanazawa University
Host in JURC KAWABATA, Takeo

Synthesis and Properties of the Supramolecular Spiral Staircase
KURAMOCHI, Koji, Graduate School of Life and Environmental Sciences, Kyoto Prefectural University
Host in JURC KAWABATA, Takeo

Synthesis of Novel Photoacoustic Contrast Agent Using Functional Metal Nanoparticles
ISHIHARA, Miya, National Defense Medical College
Host in JURC TERANISHI,Toshiharu

Chitin Nanofiber Polymer Brush for Novel Soft Materials via Self-assemble Approach
IFUKU, Shinsuke, Graduate School of Engineering, Tottori University
Host in JURC TSUJII, Yoshinobu

Molecular Simulation of Cellulosic Graft Copolymers toward Chiral Microphase Separation
YAMANE, Chihiro, Faculty of Home Economics, Kobe Women's University
Host in JURC TSUJII, Yoshinobu

Novel Scaffold Using Short Fibers Coated with Concentrated Polymer Brushes
YOSHIKAWA, Chiaki, World Premier International (WPI) Research Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS)
Host in JURC TSUJII, Yoshinobu

Development of Novel Linear π-Extended Molecules Exhibiting Fluorescence Directed toward Electronic Materials
SUGA, Seiji, Graduate School of Natural Science and Technology, Okayama University
Host in JURC MURATA, Yasujiro

Analysis of Molecular Structure in a Monolayer of Fluorinated Amphiphilic Molecules
SONOYAMA, Masashi, Graduate School of Engineering, Gunma University
Host in JURC HASEGAWA, Takeshi

Studies on Highly Efficient and Colorful Dye-sensitized Solar Cell Device Using Designed Anthocyanin
YOSHIDA, Kumi, Department of Complex Systems Science, Guraduate School of Information Science, Nagoya University
Host in JURC MURATA, Yasujiro

Dynamical Correlations between Molecules in Polymeric Liquids
SUKUMARAN, Sathish Kumar, Graduate School of Science and Engineering, Yamagata University
Host in JURC MASUBUCHI, Yuichi

Study on Size- and Shape-dependent Hydrogen Storage in Pd Nanoparticles by Time-resolved Synchrotron XRD Technique
YAMAUCHI, Miho, International Institute for Carbon-Neutral Energy Research, Kyushu University
Host in JURC TERANISHI,Toshiharu

Study on Transportation and Separation of Metal Ions through a Liquid Membrane by Complex Formation with Multidentate Ligands
MUKAI, Hiroshi, Faculty of Education, Kyoto University of Education
Host in JURC SOHRIN, Yoshiki

EXPANDING SUBJECTS
(IN SPECIFIC FIELDS CHOSEN BY JURC)

Device Developments for Fundamental Physics with Neutrons
KITAGUCHI, Masaaki, Graduate School of Science, Nagoya University
Host in JURC IWASHITA, Yoshihisa

Research and Development on Future Accelerator toward ILC project
HAYANO, Hitoshi, Accelerator Laboratory, High Energy Accelerator Research Organization
Host in JURC IWASHITA, Yoshihisa

X-ray Analysis of Structure-Function Relationship of Resorcinol Monooxygenase
OIKAWA, Tadao, Faculty of Chemistry, Materials and Bioengineering, Kansai University
Host in JURC HATA, Yasuo

X-ray Crystallographic Studies on Structure-Function of L-Asparaginase from *T. litoralis*
KATO, Shiro, Organization for Research and Development of Innovative Science and Technology, Kansai University
Host in JURC HATA, Yasuo

X-ray Structural Studies on Environmental Adaptation of Psychrophilic Aspartate Racemase
MATSUI, Daisuke, Faculty of Engineering, Toyama Prefectural University
Host in JURC HATA, Yasuo

Spin Dynamics in Group-IV Semiconductor Nanostructures
FUKATSU, Susumu, Graduate School of Arts and Science, The University of Tokyo
Host in JURC TAYAGAKI, Takeshi

Synthesis of Cyclic π-Conjugated Molecules and Their Properties
SUZUKI, Toshiyasu, Institute for Molecular Science, National Institute of Natural Sciences
Host in JURC YAMAGO, Shigeru

Elucidation of Electronic Structures of Cycloparaphenylenes
UCHIYAMA, Masanobu, Graduate School of Phamaceutical Science, The University of Tokyo
Host in JURC YAMAGO, Shigeru

Construction of Functional Molecular Organization by Supramolecular Chemistry
HAINO, Takeharu, Graduate School of Science, Hiroshima University
Host in JURC YAMAGO, Shigeru

Mechanistic Studies on the Iron-catalyzed Carbon-carbon Bond Forming Reactions: Exploring Comprehensive Approach for Solution Phase Determination of Catalytic Intermediates
NAGASHIMA, Hideo, Institute for Materials Chemistry and Engineering, Kyushu University
Host in JURC NAKAMURA, Masaharu

Synthesis of Sugar-Phenyleneethynylene Conjugates and Their Application to Fluorescent Probe
ORITA, Akihiro, Department of Applied Chemistry, Okayama University
Host in JURC NAKAMURA, Masaharu

Development of Ruthenium-Complex-Bound Amino Acids and Peptides for Oxidative Degradation of Wooden Biomasses
WATANABE, Takashi, Research Institute for Sustainable Humanosphere, Kyoto University
Host in JURC NAKAMURA, Masaharu

Development of Fluorescent Organosilicon Compounds and Elucidation of Emission Mechanism
MAEDA, Hajime, School of Chemistry, College of Science and Engineering, Kanazawa University
Host in JURC TOSHIMITSU, Akio

Synthesis of Polysubsitututed Carbon Frameworks via Selenation of Various Compounds Using Elemental Selenium
SHIBAHARA, Fumitoshi, Faculty of Engineering, Gifu University
Host in JURC TOSHIMITSU, Akio

Improvement of Metabolic and Physiological Potential Evaluator (MAPLE)
TAKAMI, Hideto, Institute of Biogeoscience, Japan Agency for Marine-Earth Science and Technology
Host in JURC GOTO, Susumu

Development of Organic-Inorganic Hybrid Polymers for Ambipolar Solar Cells
OKUBO, Takashi, Department of Chemistry, Kinki University
Host in JURC WAKAMIYA, Atsushi

Fabrication of Oxide Glass Phosphor Exhibiting Radiosensitivity
YANAGIDA, Takayuki, Kyushu Institute of Technology
Host in JURC MASAI, Hirokazu

Elucidation of Oxidation Properties for [N]Cycloparaphenylenes
NISHINAGA, Tohru, Graduate School of Science and Engineering, Tokyo Metropolitan University
Host in JURC YAMAGO, Shigeru

Synthesis, Structure, Photophysical, and Electronic Properties of Partially Overlapped Carbazolophane-Polymers
TANI, Keita, Division of Natural Science, Osaka Kyoiku University
Host in JURC TSUJII, Yoshinobu

Extensional Rheology and Self-Healing of Dynamic Network
NORO, Atsushi, Graduate School of Engineering, Nagoya University
Host in JURC MATSUMIYA, Yumi

Constraint Release Mechanism in Monodisperse Entangled Systems of Star Polymers
INOUE, Tadashi, Graduate School of Science, Osaka University
Host in JURC MATSUMIYA, Yumi

Theoretical Analysis of Dielectric Relaxation of Polymer Melts Under Fast Flow
UNEYAMA, Takashi, Division of Natural Sciences, Graduate School of Natural Science and Technology, Kanazawa University
Host in JURC MATSUMIYA, Yumi

Colloidal Crystallization and Glass Transition of Aqueous Dispersion of Polymer Microgels
TAKESHITA, Hiroki, Department of Materials Science and Technology, Nagaoka University of Technology
Host in JURC KANAYA, Toshiji

Co-crystallization of Syndiotactic Polystyrene Delta-phase Crystal and Carbxylic Acid
KAWAGUCHI, Tatsuya, Graduate School of Science, Osaka University
Host in JURC KANAYA, Toshiji

A Formation Process of the Polymer Blend Ultra Thin Films during the Spin-coating with Using the Time-resolved Grazing Incidence Small Angle X-ray Measurement
KAWAI, Takahiko, School of Science and Technology, Gunma University
Host in JURC KANAYA, Toshiji

A Study on Intermolecular Atomic Contacts Involving Chalcogen Atoms in Organic Crystals
TSUZUKI, Seiji, Nanosystem Research Institute, The National Institute of Advanced Industrial Science and Technology (AIST)
Host in JURC SATO, Naoki

Investigation of Transport Process of Bioactive Trace Metals in the South Pacific Ocean and the Antarctic Ocean
NAKAGUCHI, Yuzuru, Faculty of Science and Engineering, Kinki University
Host in JURC SOHRIN, Yoshiki

Multinuclear-NMR-study for Morphology Control of Alternating Metal-oxo Oligomers
TAKAHASHI, Masahide, Graduate School of Engineering, Osaka Prefecture University
Host in JURC KAJI, Hironori

STARTING-UP SUBJECTS
(ON-DEMAND FROM RELATED COMMUNITIES)

Characterization of Amphiphilic Compounds Involving Gluconic Acid and Perfluoroalkyl Groups
YAMADA, Norihiro, Graduate School of Education, Chiba University
Host in JURC HASEGAWA, Takeshi

Correlation between Structure of Periodic Metal Nanoparticle Arrays and Intensity of Raman Scattering from Adsorbed Molecules
SHIMADA, Toru, Faculty of Education, Hirosaki University
Host in JURC HASEGAWA, Takeshi

Development of Artificial Proteins That Target Metastable DNA Structures in Trinucleotide Repeats
HAGIHARA, Masaki, Graduate School of Science and Technology, Hirosaki University
Host in JURC IMANISHI, Miki

Delivery of Therapeutic Peptide for Hyperuricemia Using Octa-arginine Peptide
TANAKA, Gen, School of Medicine, Kyorin University
Host in JURC FUTAKI, Shiroh

Development of Biofunctional Peptide-modified Exosomes for Drug Delivery
NAKASE, Ikuhiko, Nanoscience and Nanotechnology Research Center, Osaka Prefecture University
Host in JURC FUTAKI, Shiroh

Development of Novel Gene Therapy Using Zinc Finger Proteins
NOMURA, Wataru, Institute of Biomaterials and Bioengineering, Tokyo Medical and Dental University
Host in JURC IMANISHI, Miki

Electrical Property of the Fine Bubbles and Ion Uptake Efficiency of Agricultural Crops
NIHEI, Naoto, Graduate School of Agricultural and Life Sciences, The University of Tokyo
Host in JURC TOKUDA, Yomei

Complementary Analyses of Water Structures in Biological Systems by Broadband Dielectric Spectroscopy with Other Observation Techniques
YAGIHARA, Shin, Department of Physics, School of Science, Tokai University
Host in JURC ASAMI, Koji

Elucidating Mechanism of the Structural Phase Transition Transforming Optical Properties of Photo-functional Organic Crystals
AMIMOTO, Kiichi, Graduate School of Education, Hiroshima University
Host in JURC SATO, Naoki

Development of Methods to Measure Four Wave-mixing Process in Vacuum
HONMA, Kensuke, Graduate School of Science, Hiroshima University
Host in JURC SAKABE, Shuji

Fabrication and Properties of Room Temperature-driven Nanocluster Single-Electron Transistor
MAJIMA, Yutaka, Materials & Structures Laboratory, Tokyo Institute of Technology
Host in JURC TERANISHI,Toshiharu

Study for Tunnel Magnetoresistive Effect and Local Magnetism of Magnetic Tunnel Junctions Using Co_2MnSn Heusler Alloy Electrodes Prepared by Atomically-controlled Alternate Deposition
TANAKA, Masaaki, Department of Engineering Physics, Electronics and Mechanics, Nagoya Institute of Technology
Host in JURC ONO, Teruo

Metastable Bound State between Domain Walls in Asymmetric Co/Ni Nanowire
NAKATANI, Yoshinobu, Department of Communication Engineering and Informatics, The University of Electro-Comuunications
Host in JURC ONO, Teruo

Functional Analysis of Miraculin Using *Arabidopsis thaliana*
INOUE, Hiroyasu, Department of Food Science and Nutrition, Nara Women's University
Host in JURC AOYAMA, Takashi

Role of PIP5K and ROP-GTPase in Plant Cell Morphogenesis
KUSANO, Hiroaki, Department of Technology and Science, Tokyo University of Science
Host in JURC AOYAMA, Takashi

Dynamics of the Transcription Factor ARR1 Responding to Cytokinin
KIM, Jong-Myong, Plant Science Center, RIKEN
Host in JURC AOYAMA, Takashi

EXPANDING SUBJECTS
(ON-DEMAND FROM RELATED COMMUNITIES)

Discovery and Modulation of New Cellular Functions of Vitamin D
NAGASAWA, Kazuo, Faculty of Engineering, Tokyo University of Agriculture and Technology
Host in JURC UESUGI, Motonari

Chemical Biology on Novel Lipid Modification Control
YOSHIDA, Minoru, RIKEN
Host in JURC UESUGI, Motonari

Exploration of Pyroelectricity in Charge-ordered Perovskite
TAKAHASHI, Ryota, Institute for Solid State Physics, The University of Tokyo
Host in JURC KAN, Daisuke

Magnetic and Electric Properties of Complex Iron Oxide Thin Films
FUJII, Tatsuo, Graduate School of Natural Science and Technology, Okayama University
Host in JURC SAITO, Takashi

Bulk Heterojunction Photovoltaic Devices Composed of Novel Donor Polymer and Fullerene Derivatives
IE, Yutaka, The Institute of Scientific and Industrial Research, Osaka University
Host in JURC MURATA, Yasujiro

Fusion of Structural Control and Dynamics Evaluation Aiming at Revealing Electrical Property of Organo-Metal Perovskite Single Crystal
SAEKI, Akinori, Graduate School of Engineering, Osaka University
Host in JURC WAKAMIYA, Atsushi

Analysis on the Dynamic Behavior of Cesium Ions in Soils Using Solid State NMR
FUJIMURA, Shigeto, NARO Tohoku Agricultural Research Center
Host in JURC TOKUDA, Yomei

Enzymatic Production of Chiral Amine Compounds
MIHARA, Hisaaki, Department of Biotechnology, College of LifeSciences, Ritsumeikan University
Host in JURC KURIHARA,Tatsuo

Mechanistic Studies of Microbial Degradation of Unsaturated Aliphatic Organohalogen Compounds
KURATA, Atsushi, Faculty of Agriculture, Kinki University
Host in JURC KURIHARA,Tatsuo

Intense THz Emission for Nonlinear Interaction Physics
NAGASHIMA, Takeshi, Institute of Laser Engineering, Osaka University
Host in JURC HASHIDA, Masaki

The Control of the Antiphase Boundary and the Magnetotransport Property in Ferrimagnetic Spinel Ultrathin Films
NAGAHAMA, Taro, Laboratory of Advanced Materials Chemistry, Graduate School of Engineering, Hokkaido University
Host in JURC ONO, Teruo

Control of Magnetism in Metals
CHIBA, Daichi, Department of Engineering, The University of Tokyo
Host in JURC ONO, Teruo

Development of Cystine/Glutamate Antiporter xCT Inhibitors
SATO, Hideyo, Faculty of Agriculture, Yamagata University
Host in JURC HIRATAKE, Jun

Theoretical Study on Chemoselective Acylation Catalyzed by 4-Pyrrolidinopyridine Derivatives
YAMANAKA, Masahiro, Department of Chemistry, College of Science, Rikkyo University
Host in JURC KAWABATA, Takeo

SUBJECTS FOCUSING OF JOINT USAGE OF JURC/ICR FACILITIES

Structural Elucidation of Extracellular Matrices Using Mass Spectrometry
NOMIZU, Motoyoshi, The School of Pharmacy, Tokyo University of Pharmacy and Life Sciences
Host in JURC FUTAKI, Shiroh

Melting Kinetics of Polymer Crystals by Ultra-fast-scan Calorimetry
TODA, Akihiko, Graduate School of Integrated Arts and Sciences, Hiroshima University
Host in JURC KAJI, Hironori

Structure and Function of Polymer for Solar Cell
SATO, Toshifumi, Graduate School of Engineering, Hokkaido University
Host in JURC KAJI, Hironori

Elucidation of Properties of Unsymmetrically-Substituted Disilynes
IWAMOTO, Takeaki, Graduate School of Science, Tohoku University
Host in JURC TOKITOH, Norihiro

Synthesis and Structural Elucidation of Unsaturated Silicon Compounds
MATSUO, Tsukasa, Faculty of Science and Engineering, Kinki University
Host in JURC TOKITOH, Norihiro

Study on the Chemical Bonding of Hypervalent Organotelluriums Using Precise X-Ray Analysis
MINOURA, Mao, Department of Chemistry, Rikkyo University
Host in JURC TOKITOH, Norihiro

Analysis of Bonding State of High Coordinate Compounds of Main Group Elements by X-Ray Diffraction Method
HASHIZUME, Daisuke, Center for Emergent Matter Science, RIKEN
Host in JURC TOKITOH, Norihiro

Synthesis of Heteroatom Compounds with Exotic Structures and Their Structures and Properties
SAITO, Masaichi, Department of Chemistry, Graduate School of Science and Engineering, Saitama University
Host in JURC TOKITOH, Norihiro

Synthesis and Structure of Main Group Element-Protected Metal Nanoparticles
FUJIHARA, Hisashi, Department of Chemistry, Fuculty of Science and Engineering, Kinki University
Host in JURC TOKITOH, Norihiro

Study of High Photonic Density Nano-Cavity by Electron Probe Spectroscopy
YAMAMOTO, Naoki, Quantum Nanoelectronics Research Center, Tokyo Institute of Technology
Host in JURC KURATA, Hiroki

The Mechanism of Chain Polymerization of a Diacetylene Compound 10,12-Pentacosadiyn-1-ol Molecular Layers Adsorbed on Graphite Studied by STM
TAKAJO, Daisuke, Graduate School of Science, Osaka University
Host in JURC KURATA, Hiroki

Fabrication of Metal Nano-ring by Soft-template Method
KAWAI, Takeshi, Faculty of Engineering, Tokyo University of Science
Host in JURC KURATA, Hiroki

Crystal Structures of *Peri*-aroylnaphthalene Compounds with Restricted Molecular Alignment of Aroyl Groups
OKAMOTO, Akiko, Department of Organic and Polymer Materials Chemistry, Tokyo University of Agriculture and Technology
Host in JURC ISOZAKI, Katsuhiro

High-resolution Mass Spectrometry of Magic Metal Clusters
NEGISHI, Yuichi, Department of Applied Chemistry, Tokyo University of Science
Host in JURC TAKAYA, Hikaru

SUBJECTS ENCOURAGING JOINT PROGRAM

Investigations of Oxygen Ion Transport by Synchrotron X-ray
MIZUMAKI, Masaichiro, Japan Synchrotron Radiation Research Institute, SPring-8
Host in JURC ICHIKAWA, Noriya

The 10th International Workshop for East Asian Young Rheologists
TAKAHASHI, Yoshiaki, Institute for Materials Chemistry and Engineering, Kyushu University
Host in JURC WATANABE, Hiroshi

JURC Publications (Selected Examples)

(until 31 May 2014)

Development of a Novel Nanoparticle by Dual Modification with the Pluripotential Cell-Penetrating Peptide PepFect6 for Cellular Uptake, Endosomal Escape, and Decondensation of an siRNA Core Complex

Mitsueda, A.; Shimatani, Y.; Ito, M.; Ohgita, T.; Yamada, A.; Hama, S.; Gräslund, A.; Lindberg, S.; Langel, Ü.; Harashima, H.; Nakase, I.; Futaki, S.; Kogure, K., *Biopolymers*, **100,** 698-704 (2013).

Abstract

Development of novel devices for effective nucleotide release from nanoparticles is required to improve the functionality of nonviral delivery systems, because decondensation of nucleotide/polycation complexes is considered as a key step for cytoplasmic delivery of nucleotides. Previously, PepFect6 (PF6) comprised chloroquine analog moieties and a stearylated cell-penetrating peptide to facilitate endosomal escape and cellular uptake, respectively, was developed as a device for efficient siRNA delivery. As PF6 contains bulky chloroquine analog moieties, the polyplexes are expected to be loose structure, which facilitates decondensation. In the present study, siRNA was electrostatically condensed by PF6, and the PF6/siRNA complexes were coated with lipid membranes. The surface of the nanoparticles encapsulating the PF6/siRNA core (PF6-NP) was modified with PF6 for endosomal escape (PF6/PF6-NP). The RNAi effect of PF6/PF6-NP was compared with those of stearylated cell-penetrating peptide octaarginine (R8)-modified PF6-NP, R8-modified nanoparticles encapsulating the R8/siRNA core (R8-NP) and PF6-modified R8-NP. Nanoparticles encapsulating the PF6 polyplex, especially PF/PF-NP, showed a significant knockdown effect on luciferase activity of B16-F1 cells stably expressing luciferase. siRNA was widely distributed within the cytoplasm after transfection of the nanoparticles encapsulating the PF6 polyplex, while siRNA encapsulated in the R8-presenting nanoparticles was localized within the nuclei. Thus, the siRNA distribution was dependent on the manner of peptide-modification. In conclusion, we have successfully developed PF6/PF6-NP exhibiting a potent RNAi effect resulting from high cellular uptake, efficient endosomal escape and decondensation of the polyplexes based on the multifunctional cell penetrating peptide PF6. PF6 is therefore a useful pluripotential device for siRNA delivery.

Infrared Spectroscopic Study of Stereo-controlled Poly(*N*-isopropylacrylamide) with an Extended Chain Conformation Induced by Adsorption on a Gold Surface

Shimoaka, T.; Rikiyama, K.; Katsumoto, Y.; Hasegawa, T., *Anal. Bioanal. Chem*., **405,** 9411-9418 (2013).

Abstract

Poly(*N*-isopropylacrylamide) (PNiPAM) compounds with various diad tacticities were prepared, and the molecular interaction properties in a thin film deposited on a gold surface were analyzed using infrared spectroscopy. The intramolecular and intermolecular interactions were found to depend on the tacticity, and only atactic (diad ratio 46 %) PNiPAM exhibits poor molecular interaction even in the bulk sample. On the other hand, the same series of compounds dissolved in an acetone solution were spread on a gold surface to form a thin film. In the dissolution process, the polymer molecules are relaxed via solvation, and they are bound to the gold surface by a molecular interaction to form a submonolayer thin film. In the thin film, the molecular interaction with the gold surface via the N−H group was monitored in the infrared spectra only for a nearly isotactic (m=90) PNiPAM by an apparent shift of the N−H stretching vibration band. This shift was confirmed by changing the degree of hydrophilicity of the gold surface: a larger shift is found on a gold surface with stronger hydrophilicity. As a result, the conformation of a nearly isotactic molecule is found to be extended by the interaction with the gold surface, which works to immobilize the molecule.

Synthesis and Physical Properties of a Ball-like Three-dimensional π-Conjugated Molecule

Kayahara, E.; Iwamoto, T.; Takaya, H.; Suzuki, T.; Fujitsuka, M.; Majima, T.; Yasuda, N.; Matsuyama, N.; Seki, S.; Yamago, S., *Nature Commun*., **4,** 2694 (2013).

Abstract

Curved π-conjugated molecules with closed and three-dimensional (3D) structures, such as fullerenes and carbon nanotubes, have been the subject of intensive research due to their potential applications in molecular electronics. However, basic molecular skeletons of 3D molecules are limited because of the lack of a rational and selective synthetic method by organic synthesis. Here we report the synthesis of a 3D π-conjugated molecule based on the platinum-mediated assembly of four molecules of a stannylated trisubstituted benzene derivative forming a hexanuclear platinum complex with an octahedral shape, from which reductive elimination of platinum gave the target molecule. As many supramolecular transition metal–ligand complexes with 3D cages and polyhedral structures have been synthesized by self-assembly of ligands and metals, the current assembly/reductive elimination strategy could provide a variety of new 3D π-conjugated molecules with different structures and topologies, which are challenging to obtain using conventional synthetic methods.

VMAT2 Identified as a Regulator of Late-stage β Cell Differentiation

Sakano, D.; Shiraki, N.; Kikawa, K.; Yamazoe, T.; Kataoka, M.; Umeda, K.; Araki, K.; Mao, D.; Matsumoto, S.; Nakagata, N.; Andersson, O.; Stainier, D.; Endo, F.; Kume, K.; Uesugi, M.; Kume, S., *Nat. Chem. Biol*., **10,** 141-148 (2014).

Abstract

Cell replacement therapy for diabetes mellitus requires cost-effective generation of high-quality, insulin-producing, pancreatic β cells from pluripotent stem cells. Development of this technique has been hampered by a lack of knowledge of the molecular mechanisms underlying β-cell differentiation. The present study identified reserpine and tetrabenazine (TBZ), both vesicular monoamine transporter 2 (VMAT2) inhibitors, as promoters of late-stage differentiation of *Pdx1*-positive pancreatic progenitor cells into *Neurog3* (referred to henceforth as *Ngn3*)-positive endocrine precursors. VMAT2-controlled monoamines, such as dopamine, histamine and serotonin, negatively regulated β-cell differentiation. Reserpine or TBZ acted additively with dibutyryl adenosine 3',5'-cyclic AMP, a cell-permeable cAMP analog, to potentiate differentiation of embryonic stem (ES) cells into β cells that exhibited glucose-stimulated insulin secretion. When ES cell–derived β cells were transplanted into AKITA diabetic mice, the cells reversed hyperglycemia. Our protocol provides a basis for the understanding of β-cell differentiation and its application to a cost-effective production of functional β cells for cell therapy.

Measurement of Transient Photoabsorption and Photocurrent of $BiFeO_3$ Thin Films: Evidence for Long-lived Trapped Photocarriers

Yamada, Y.; Nakamura, T.; Yasui, S.; Funakubo, H.; Kanemitsu, Y., *Phys. Rev. B*, **89,** [035133-1]-[035133-5] (2014).

Abstract

We have studied the optical response and dynamical behavior of photocarriers in $BiFeO_3$ thin films by means of transient absorption (TA) and photocurrent (PC) measurements. PC and absorption spectroscopy indicate that $BiFeO_3$ thin films have an indirect band gap energy of ～2.4 eV. The TA and PC decay dynamics have fast (～1 ns) and slow

(～100 ns) components that are attributed to the localization of free carriers to shallow trap states and the recombination of trapped carriers, respectively. The long decay time of the PC is caused by the thermal activation of trapped carriers into the conduction band. Long-lived trapped photocarriers can be linked to the ferroelectricity and give rise to unique photoinduced phenomena in $BiFeO_3$.