

International Workshop on Molecular Technology for Photo-electro Organics



International Workshop on Molecular Technology for

Photo-electro Organics

Welcome

Dear participants,

It is our great pleasure to welcome all participants to the International Workshop on Molecular Technology for Photo-electro Organics organized jointly by University of Bordeaux (France) and Kumamoto University (Japan). The aim of this workshop is to bring together people working on the advanced organic materials and polymers for photonics, electronics and related technologies. We would like to give our special thanks your contribution to this workshop and wish you to have fruitful discussions and future collaborations.



Prof. Hirotaka Ihara

I would like to address a very special thanks to our Japanese guests for coming to Bordeaux to attend this meeting. I hope you will find this workshop both exciting and useful for developing future collaborations and I wish you a very enjoyable stay.

Dr. Reiko Oda



Sponsors: *Strategic Young Researcher Overseas Visits Program for Accelerating Brain Circulation,*

Japan Society for the Promotion of Science (JSPS, Japan), Centre national de la recherche scientifique (CNRS, France)

International Workshop on Molecular Technology for Photo-electro Organics

Date: March 21, 2014

Venue: University of Bordeaux, Bordeaux, France

Organizer: *University of Bordeaux (France)*

Kumamoto University (Japan)

Co-organizer: *Centre national de la recherche scientifique (CNRS, France)*

Kumamoto Institute for Photo-electro Organics (Phoenics, Japan)

10:30 *Introductory Remarks*

Dr. Hirotaka Ihara, Professor, Vice president (Kumamoto University, Phoenics)

10:40 *Invited Lecture*

Dr. Seiji Kurihara, Professor (Kumamoto University, Phoenics)

" Photo-switching of reflection from 1-D Photonic Crystals "

11:05 *Invited Lecture*

Dr. Victor Maurizot, Research Assoc.(CNRS, University of Bordeaux)

"Aromatic Foldamers : how to control molecular shape and assembly"

11:30 *Young Researcher Lecture*

Dr. Rintaro Higuchi, Researcher (Kumamoto University, Researching at University of California, Los Angeles)

" Polyaniline-based Atomic Switches "

11:50 Lunch

14:00 *Invited Lecture*

Dr. Dario Bassani, Research Director (CNRS, University of Bordeaux)

"Supramolecular routes to materials for organic electronics"

14:45 *Young Researcher Lecture*

Mr. Yutaka Okazaki, PhD Student (Kumamoto University, Researching at University of Bordeaux)

"Chiral orientation of organic dye using helical colloidal silica"

15:05 *Young Researcher Lecture*

Mr. Hiroki Noguchi, PhD Student (Kumamoto University, Researching at University of Bordeaux)

" Application of foldamer as a chiral sensing material"

15:25 Coffee Break

15:45 *Invited Lecture*

Dr. Emilie Pouget, Research Assoc. (CNRS, University of Bordeaux)

" Hybrid nano-helices: from the organic self-assembly to the design of functional nanostructures"

16:10 *Young Researcher Lecture*

Dr. Yutaka Kuwahara, Assist. Professor (Kumamoto University, Researching at Brookhaven National Laboratory)

"catalytic CO₂ reduction with metal complexes"

16:35 *Young Researcher Lecture*

Dr. Naoya Ryu, Researcher (Kumamoto University, Researching at University of Bordeaux)" **Chiral dye aggregation induced by twisted silica ribbon"**

17:00 *Invited Lecture*

Dr. Makoto Takafuji, Assoc. Professor (Kumamoto University, Phoenixics)

"Nanoparticle-crosslinked hybrid hydrogels"

17:25 *Closing Remarks*

Dr. Reiko Oda, Research Director (CNRS, University of Bordeaux)



Seiji Kurihara

> [Fonction]

Photo-switching of reflection from 1-D Photonic Crystals

CV .

PhD at Tokyo Institute of Technology in 1990. He then obtained the position of Kumamoto University. His research interest is in the field of functional polymers and organic materials.



Abstract

We prepared 1-dimensional photonic crystals (1D-PCs) having multi-bilayered structure by alternative spin coating of azobenzene polymer liquid crystals (Azo PLCs) and polyvinyl alcohol (PVA). The 1D-PCs reflected a light corresponding to thickness of layers and refractive indices of the Azo PLCs and PVA.

1D-PC consisting of PAzo1 (Fig.1) and PVA was found to show disappearance of reflection of light by heating at 80 °C. This is related to the molecular orientation of mesogenic side groups in the Azo PLCs: PAzo1 showed an out-of-plane molecular orientation on the PVA layer by heating.

Fig. 2 shows the change in the reflection spectra of 1D-PC consisting of PAzo1 and PVA by UV irradiation. The UV irradiation resulted in transformation from out-of-plane molecular orientation to in-plane random orientation by photoisomerization of azochromophores in PAzo1. This is due to the disordering effect of cis-forms having bended shape of the azobenzene chromophore. Consequently, on-off switching of reflection of 1D-PC could be achieved [1, 2].

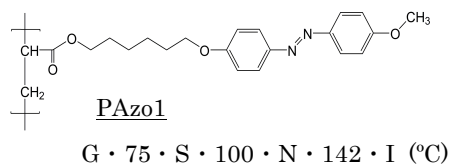


Fig. 1 Structure and phase transition behaviour of Azo PLCs.

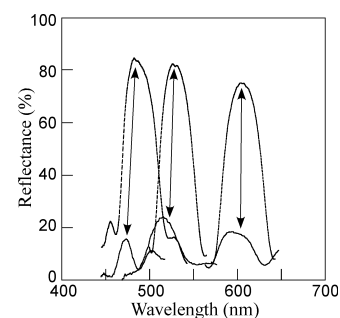


Fig. 2 Change in the reflection spectra of 1D-PC of PAzo1 and PVA by UV irradiation.

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References:

[1] Moritsugu et al., *Macromol. Rapid Comm.* **32**, 1546 (2011).

[2] Yagi et al., *Polymer*, **55**, 1120 (2014).

Victor Maurizot

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Aromatic Foldamers : how to control molecular shape and assembly



CV .

Victor Maurizot has done most of his studies at the university of Orléans where he get his master in 1998. After one year of predoctoral studies in Montpellier and in Halle in Germany, he moved to Bordeaux for his PhD that he obtained in 2003. He then did a two years postdoc at the University of Tokyo and one year at the University of Texas in Austin. He then obtained a position of researcher at the CNRS in 2007. His research interest is in the field of supramolecular chemistry and especially in Foldamers.

Abstract

Controlling the shape of molecules in order to control functional groups orientation has attracted lots of attentions in the field of medicinal chemistry in order to achieved molecular recognition for specific substrates but also in the filed of material to control their physico-chemical behaviour. Our group has developed a wide variety of helical aromatic foldamers (non natural oligomers that adopt folded conformation in solution) that show remarkable stability and that can be seen as molecular rods on which functional groups could be attach at specific position. Fonctional groups will be used to control self assembly of these molecular architectures and for substrat recognition.

Rintaro Higuchi

Polyaniline-based Atomic Switches



CV .

A bachelor degree in 2006 at the Kumamoto University, PhD in 2013. He then had a year of visiting scholar at University of California Los Angeles. His research interest is in the field of π -conjugated polymer materials and devices.

Abstract

The atomic switch is one of the devices in a class of circuit elements that display resistive switching behavior, which composed of a metal-insulator (metal sulfide)-metal junction such as Ag/Ag₂S/Ag architecture. The devices have a reversible low conductance (OFF) state and a high conductance (ON) state depending on the applied voltage. Interestingly, changes in conductance are influenced by the history of previous input signals. In view of these memristive properties, the atomic switch is regarded as a “synthetic synapse”. The motivation of this study is to construct polymer-based atomic switches for use as organic synthetic synapses. Polymer-based atomic switches are attractive due to their ease of operation and simple structure, flexibility, and processability.

We demonstrate that devices with a polyaniline (PANI) / metal sulfide junction work as non-volatile resistive switches (Fig. 1). In addition, metal ion-diffused PANI devices with no metal sulfide layer also showed switching properties. In both systems, the short- and long-term memories were observed by applying pulsed voltage. These synaptic responses and further morphology control of PANI materials pave the way for next-generation polymeric “neuromorphic hardware”.

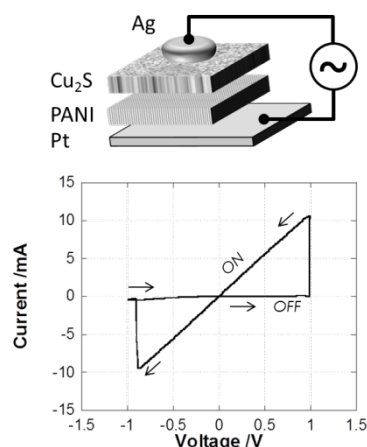


Fig. 1 Typical PANI-based atomic switch architecture and the I-V curve.

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Supramolecular routes to materials for organic electronics



CV

Masters in Chemistry from the Université Catholique de Louvain (Belgium) in 1988, followed by a PhD in Chemistry from Northwestern University (1993). Then, Hoffman-La Roche Fellowship at the Institut für Physikalische Chemie (Universität Basle, Switzerland) and Pierre and Marie Currie Fellowship at the Université Luis Pasteur (Strasbourg, France). Since 1997 CNRS researcher at the University of Bordeaux.

Abstract

We investigate the use of supramolecular interactions to develop new routes to materials of use for organic electronics. For example, the use of reversible covalent bonds to assist the layer-by-layer exfoliation of graphene is particularly promising for the development of conducting transparent electrodes. Likewise, the self-assembly of solution-processable small molecules into nanometer-sized spheres can be used to side-step current top-down limitations in the development of super high-resolution OLED devices.

Emilie POUGET

> CNRS assistant
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Hybrid nano-helices: from the organic self-assembly to the design of functional nanostructures



CV .

Emilie Pouget received her bachelor degree in 2002 from the Polytechnic National Institute of Toulouse, with a specialization in material science. After a PhD obtained in Rennes in 2006, she had 2 years post-doc in Eindhoven (Netherland) and 3 other years in Bordeaux. She obtained the position of assistant researcher in CBMN in 2011. Her research interest is in the field of organic molecular self-assembly and hybrid organic/inorganic structures in order to develop new nanofabrication strategies.

Abstract

Functional hybrid nano-helices are synthesized by use of organic chiral self-assemblies forming very well defined helix or ribbon structures as templates. A bio-inspired mineralization of these self-assemblies allows creating silica nano-helices with very well controlled morphologies. After discussing the synthesis of these hybrid nano-objects, we will present the use of these structures as functional materials for three applications currently studied in our lab: the development of semiconductor helices for NanoElectroMechanical Systems, the formation of nano-helices decorated with gold nanoparticles to create systems efficient for the Surface Enhanced Raman Spectroscopy or the metamaterials, and finally we will present a study using these chiral structures as base for the stem cell differentiation in the tissue engineering field.

Yutaka Okazaki

> PhD student

Chiral orientation of organic dye using helical colloidal silica



CV .

A master's degree in 2010 at the Kumamoto University. He then was engaged in the research of high thermostability resin in Nippon Steel Chemical Co. Ltd. He then started doctor course in April 2013. He has been working in a group ODA from July 2013 funded by Strategic Young Researcher Overseas Visits Program for Accelerating Brain Circulation. His research interest is in the field of self-assemblies, chiral orientation and nanostructural alignment.

Abstract

Chiral surface has been attracted because of their potential to apply in various fields, such as catalytic chemistry, molecular recognition and photo-electronics. Especially, chiral induction of achiral molecules organized on a chiral surface is now one of the key technologies in photo-electronics. To achieve this goal, several chiral surface has been investigated, *e.g.*, biomolecules, self-assemblies, and the inorganic substrates. Self-assemblies have advantages of easiness of chirality control. However, these surfaces have distinctive disadvantage due to their thermostability. In order to overcome this problem, we fabricated nanometric helical silica by sol-gel reaction using molecular assemblies of chiral surfactants "16-2-16 tartrate" as template. And we successfully suspended these helical silica in water to become colloid state. By the measurement of vibrational circular dichroism (VCD), VCD spectra have been observed in this helical silica. After mixing colloidal silica and dye aqueous solution, UV spectra of dye have drastically shifted and CD spectra have been observed at the shifted peak. In this presentation, we report a facile and effective chiral induction of achiral organic dye using helical colloidal silica as a chiral surface.

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Hiroki Noguchi

> PhD student

Application of foldamers as chiral sensing material



CV .

Hiroki Noguchi received his bachelor degree in 2011 and his Master in 2013 at the Kumamoto University. He is a 1 year PhD student at the Kumamoto University, currently doing research at the IECB, supported by JSPS. His research interest is in the field of molecular recognition by chiral surface.

Abstract

Chiral recognition is one of the most challenging fields in molecular science since only few materials are available for chiral sensing material. An effective approach to achieve this is to use as recognition motives helical structures that by themselves are chiral. Difficulty arises from the fact that these structures should be stable and not racemic. Quinoline-based foldamers are good candidate for chiral sensing materials because of its attractive properties such as stability of helical structure in various organic solvents, high handedness controllability. The aim of this study is to investigate chiral recognition ability of quinoline-based foldamers by accumulating them onto silica surface as chiral stationary phases. For this purpose, 3 quinoline-based foldamers of different size has been synthesized, they will then be grafted on silica and their chiral separation ability will be tested. These compounds have been characterized by NMR (^1H and ^{13}C), Mass spectrometry and UVCD for handedness control confirmation.

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Yutaka Kuwahara

> [Fonction]

A collaborative research for
catalytic CO₂
reduction with
metal complexes



CV .

A bachelor degree in 1997 at the Kyushu University, Dr. Eng. in 2002. He then obtained the position of Research Associate. He then obtained the position of Assistant Professor. Her research interest is in the field of photo-functional materials.

Abstract

The surroundings like a solvent and pH value in reaction conditions significantly affects to chemical reaction. In this study, we have focused and investigated catalytic reaction of CO₂ reduction with Re complexes. The Re complexes, which exhibit selective reduction of CO₂ to CO in organic solvents, have been used as homogenous electrocatalyst and photocatalyst. By change solvent of the catalytic reaction with ReCl(bpy)(CO)₃, higher electrocatalytic activity than that in acetonitrile is found.

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Naoya Ryu

> Researcher

Chiral aggregation of organic dye induced by twisted silica ribbon



CV .

Naoya Ryu received his PhD degree from Sojo University in 2011. After spending a year at a company as an engineer, he had a postdoctoral position at Kumamoto University. Currently, he is staying at University of Bordeaux. His research interest is in the field of organic-inorganic hybrid materials and self-assembly.

Abstract

Chiral aggregation of functional dyes has attracted a good deal of attention because of their potential applications in optoelectronic devices. In this study, we found that circular dichroism (CD) of H-aggregates of an achiral anionic dye, methyl orange (MO), is induced in water at pH 3.0 (Fig. 1) by twisted silica ribbons which were prepared by sol-gel transcription of chiral bilayer aggregates of cationic gemini surfactants. In this presentation, we will present the concentration and temperature dependencies of MO and other ionic dyes in the presence of the twisted silica ribbons on the ultraviolet-visible (UV-Vis) absorption and CD spectral properties.

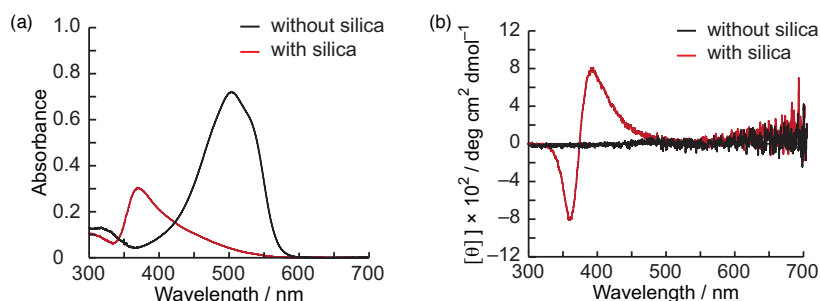


Fig. 1 UV-Vis absorption (a) and CD (b) spectra of MO in the presence and absence of right handed twisted silica ribbon in water at pH 3.0; [MO] = 0.02 mM, [silica ribbon] = 0.04 mg mL⁻¹, temperature: room temperature (a) and 20 °C (b), pathlength: 1.0 cm.

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Makoto Takafuji

> Ph.D, Associate Prof.

Nanoparticle-crosslinked hybrid hydrogels



CV .

He had PhD at 1994 in Kumamoto University. He then worked in the chemical company, Kohjin Co. for 6 years. Then he obtained the position of assistant professor at Kurume National Collage of Technology. After one year, he moved to Kumamoto University and was promoted to associate professor at 2005. His research interest is in the field of polymer hybrid material and self-assembly.

Abstract

Recently hybrid hydrogels containing nanoparticles have been attracting considerable attention because of their unique properties. We also reported novel hybrid hydrogels^{1,2)} which can be prepared in a facile manner by simple mixing of a water-soluble copolymer having trimethoxysilyl side chains with silica nanoparticles in aqueous solution. Silica nanoparticles work as multiple crosslinkers to form the polymer network structure (Fig. 1). In this hybrid hydrogel sysmte, the gel properties such as mechanical and swelling properties can be easily tuned by changing the compositions of the reactive copolymer and nanoparticles.

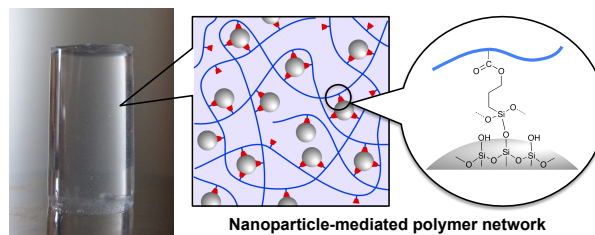


Fig. 1 Nanoparticle-crosslinked hybrid hydrogels.

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1) *Chem. Commun.*, Vol. 47, pp. 1024-1026 (2011).

2) *J. Colloid Interface Sci.*, Vol. 405, pp. 109-117 (2013).