

INSD NanoScience Video Exchange Lectures (2018, Groningen-Osaka)

These lectures are held as a part of “**Fundamental and functional properties of nanomaterials**” in top Master NanoScience in Groningen and as “**International Exchange Lectures on Nanoscience and Nanotechnology A**” in INSD Nano Program in Osaka. The program is also shared by University of Science-Malaysia, King Mongkut’s Institute of Technology Ladkrabang-Thailand, and Institute for Materials Science VAST-Vietnam.

The lectures except for October 12th start on the following Fridays at 9:00 in the morning (Groningen time), that is, at 16:00 or 17:00 in the afternoon (Osaka time).

[NOTE The Netherlands switches from summer time (day light saving time) to winter time on the night of 28 October (Sun) 01:00 (UTC) 2018.]

Lecture 0

Friday 12, Oct. 2018

Osaka time: 14:40-16:40 (no exchange lecture from Groningen)

Prof. Tadashi Itoh, Institute for NanoScience Design (speaks 14:40-16:40 (O))

(Field: solid state physics, semiconductor nanocrystal (quantum dot), optical properties)

Title: Introduction, Photophysics of quantum dots.

(Together with video address and Nobel-Prize lecture given by Prof. Benard L. Feringa)

Abstract: Electronic excited states (excitons) in semiconductor nanocrystals show peculiar quantum size effects which exhibit various kinds of characteristic optical properties; blue shift and splitting of the exciton energy states, rapid radiative decay, ultrahigh speed giant optical nonlinearity, highly efficient lasing, etc.

Lecture 1

Friday 19, Oct. 2018

Osaka time: 16:00-18:15

Groningen time: 9:00-11:00

Chair: Prof. Tadashi Itoh

Prof. Syoji Ito, Graduate School of Engineering Science (speaks 16:00-16:55 (O)/ 9:00-9:55 (G))

(Field: laser manipulation, single-molecule detection)

Title: Single-molecule fluorescence detection: methods and applications

Abstract: The lecture starts with the history of single-molecule fluorescence detection (SMFD) and the introduction of typical methods of SMFD: confocal and wide-field microscopies. Then several important applications of SMFD are shown, e.g. fluorescence correlation spectroscopy, single-molecule tracking, and super-resolved fluorescence imaging.

Chair: Prof. Thomas Jansen

Prof. Remco Havenith (speaks 10:00-10:55 (G) / 17:00-17:55 (O))

(Field: Theoretical Chemistry)

Title: Calculation of molecular properties

Abstract: I shall talk about the calculation of molecular properties. Techniques for calculating

properties will be discussed and examples of applications will be shown. Main topics that will be discussed is the calculation of magnetically induced current densities and NMR chemical shifts.

Lecture 2

Friday 26, Oct. 2018

Osaka time: 16:00-18:15

Groningen time: 9:00-11:00

Chair: Prof. Tadashi Itoh

Prof. Akira Harada, Graduate School of Science (speaks 16:00-16:55 (O) / 9:00-9:55(G))

(Field: macromolecules, self-assembly, self-healing)

Title: Supramolecular materials

Abstract: Macromolecular recognition is classified as main-chain recognition and side chain recognition. Main-chain recognition is involved in the formation of polyrotaxanes in which some cyclic molecules are threaded onto a polymer chain. We have studied on the relative movement of cyclic parts and a linear chain. We can control the rates and the direction of the cyclic parts on a polymer chain. In addition, we have achieved macroscopic self-assembly and self-healing systems through side-chain recognition.

Chair: Prof. Thomas Jansen

Prof. Jan Anton Koster (speaks 10:00-10:55 (G) / 17:00-17:55 (O))

(Field: Photophysics and optoelectronics, semiconductors and devices, thermoelectrics)

Title: Organic semiconductors for thermoelectrics

Abstract: In this lecture, I will introduce organic semiconducting materials and will briefly review their charge transport properties. Next, I will emphasize their promise for thermoelectric applications.

Lecture 3

Friday 9, Nov. 2018

Osaka time: 17:00-19:15

Groningen time: 9:00-11:00 (in winter time)

Chair: Prof. Tadashi Itoh

Prof. Yasufumi Fujiwara, Graduate School of Engineering (17:00-17:55 (O) / 9:00-9:55(G))

(Field: rare-earth-doped semiconductors, OMVPE growth, LED, luminescence, energy transfer)

Title: Fundamentals of light-emitting diode with rare-earth-doped semiconductors

Abstract: After the groundbreaking invention of blue and green light-emitting diodes (LEDs) employing nitride semiconductors ($\text{In}_x\text{Ga}_{1-x}\text{N}/\text{GaN}$), there has been a strong demand to develop red LEDs using nitride semiconductors. We have focused on europium (Eu) ions that have been widely used as an activator for red phosphor, and have succeeded in growing Eu-doped GaN (GaN:Eu) layers with high crystalline quality by atomically-controlled organometallic vapor phase epitaxy (OMVPE), as well as developing the world's first red LED that operates at room temperature using GaN:Eu as the active layer. This lecture will cover current status of conventional GaN-based LEDs and the GaN:Eu red LED, present understanding of Eu luminescent sites formed in GaN and future strategies for the improved light output of the LEDs.

Chair: Prof. Thomas Jansen

Prof. Moniek Tromp (speaks 10:00-10:55 (G) / 18:00-18:55 (O))

(Field: characterization of materials and catalysis, new materials to develop better batteries)

Title: Dynamic processes in batteries

Abstract: An important element in the reduction of CO₂ is the change of vehicles with internal combustion engines to electric battery powered vehicles. The as such produced renewable energy can be used for individual mobility as well as for a temporary intermediate storage of excess energy. A viable electric mobility concept requires however stable cycle batteries with high specific energy. In this lecture I will explain operando X-ray absorption, emission and imaging techniques and how they can be used to characterize batteries during cycling. Insights in reaction and deactivation mechanisms will be presented and future battery materials and cell developments will be described.

Lecture 4

Friday 16, Nov. 2018

Osaka time: 17:00-19:15

Groningen time: 9:00-11:00 (in winter time)

Chair: Prof. Tadashi Itoh

Prof. Yoshito Tobe, Institute of Scientific and Industrial Research

(17:00-17:55 (O) / 9:00-9:55(G))

(Field: supra-molecule electronics)

Title: Self-assembled monolayers on surfaces

Abstract: Self-assembly of molecules plays a central role in the bottom-up approach to nano-science/technology. In particular, control over the physical (i.e. non-covalent) or chemical (i.e. covalent) adsorption of molecules on surfaces or at liquid-solid interfaces via non-covalent interactions has developed remarkably during the last few decades and has reached to a molecular-scale or even an atomic-scale level. After a general introduction to self-assembly, representative examples of self-assembled monolayers will be presented, and their control strategy and potential application will be discussed.

Chair: Prof. Thomas Jansen

Prof. Thomas la Cour Jansen (speaks 10:00-10:55 (G) / 17:00-17:55 (O))

(Field: computational spectroscopy and optical properties)

Title: Dynamics in Perovskite Materials

Abstract: In this lecture, I will discuss the fast dynamics of the organic ions in lead halide perovskite materials and how it can be measured in real-time. I will further discuss the short-range correlation in the ordering of the ions and how this may be utilized.