第228回 OPERA研究交流セミナー
第219回 ISIT有機光エレクトロニクス研究特別室セミナー
第286回 未来化学創造センターセミナー

日時：2023年10月18日(水) 13：30～
場所：ISI棟3階 セミナー室

Dr. Benoit Heinrich,

Strasbourg Institute of Material Physics and Chemistry (IPCMS, France)

How can X-ray scattering/diffraction techniques be used
to investigate the structure and
the morphology of materials, and to guide the design of
molecular systems?

Dr. Nicolas Fabre, CEA Saclay, France

From fluorescence photoswitching to 2D materials:
photonics and applications of perylene derivative

主催：九州大学　最先端有機光エレクトロニクス研究センター
　　：財団法人九州先端科学技術研究所（ISIT）
共催：九州大学　未来化学創造センター

How can X-ray scattering/diffraction techniques be used to investigate the structure and the morphology of materials, and to guide the design of molecular systems? / Dr. Benoit Heinrich

Nowadays, Single Crystal X-ray Diffraction (SCXRD) has become a key tool for the chemists as it definitively validates the chemical formula and offers a direct view of the conformation of molecules. However, crystallography and X-ray scattering/diffraction techniques can do much more than that, and primarily evidence the self-organization of molecules in any condensed matter states. As a matter of fact, this knowledge clarifies the way in which molecules interact, and ultimately the relationship between the properties of the molecules and the properties of the materials.
This presentation overviews how X-ray scattering/diffraction techniques reveal the features of the structure and the morphology of materials, going from single crystal to crystalline powders and to mesomorphic states. Beyond the instrumental setups available in laboratories to study bulk materials, it will be shown that synchrotron techniques allow to investigate the materials shaped as thin films for device applications. From this knowledge combined with the measured device performances, the efficiency of a material, a molecular architecture or a fabrication procedure can be evaluated and the new systems/procedures be designed. This discussion will be illustrated with examples selected from collaboration works with OPERA.

“From fluorescence photoswitching to 2D materials: photonics and applications of perylene derivative” / Dr. Nicolas Fabre

This presentation will focus on the photonics properties of fluorescents molecules based on perylene derivative. First part will be dedicated to fluorescence photoswitching. Photochromic/fluorescent dyads lead to photoswitchable emissive systems through energy transfer processes. The profile of the response between the fluorescence signal and the conversion yield of the photochromic moiety depends on the environment. When gathered into nanoparticles, cooperative effect occurs leading to interesting phenomena. Design and synthesis of diarylethene/perylenediimide architectures will be presented. Steady-state and time resolved spectroscopy were conducted to investigate and characterize the energy transfer process. Moreover, fluorescence photoswitching was performed on individual nanoparticles allowing us to observe an interesting fluorescence recovery profile. Finally, super-resolution experiments were conducted using such nanoparticles. Second part focus on 2D material. Two dimensional (2D) materials are a class of materials with unique properties that have attracted significant attention in recent years. Preparation of 2D materials based on organic molecules is a key-point to obtain devices with original photonics functionalities. Herein, we focused on 2D materials based on perylenediimide derivative. Our goal was to prepare highly oriented 2D materials while also controlling molecular orientations and intermolecular electronic interactions. The consequences on photonics processes will be presented.