Visiting Professors

Visiting Professor
SAKURAI, Hidehiro *(from Osaka University)*

Nanoscience Based on the Synthetic Organic Chemistry

Bowl-shaped π-conjugated compounds including partial structures of the fullerenes, which are called "buckybowls," are of importance not only as model compounds of fullerenes but also as their own chemical and physical properties. Very few buckybowls has been achieved for preparation mainly due to their strained structure. We develop the rational route to the various buckybowls and investigate their physical properties. We also investigate to develop novel catalytic properties of metal nanoclusters. We focus on the following projects: Preparation of size-selective gold and gold-based alloy nanoclusters supported by hydrophilic polymers and its catalytic activity: Development of designer metal nanocluster catalyst using the highly-functionalized protective polymers.

Visiting Professor
UCHIHASHI, Takayuki *(from Nagoya University)*

Dynamic Structural States of ClpB Involved in Its Disaggregation Function Revealed by High-Speed Atomic Force Microscopy

Protein disaggregation machines, ClpB in bacteria belonging to the AAA+ superfamily, refolds toxic protein aggregates into the native state in cooperation with the cognate Hsp70 partner. The ring-shaped hexamers of ClpB uses ATP to unfold and thread its protein substrate through the central pore. However, their function-related structural dynamics has remained elusive. We directly visualized the ClpB using high-speed atomic force microscopy (HS-AFM) to gain a mechanistic insight into its disaggregation function. The HS-AFM movies demonstrated massive conformational changes of the hexameric ring during the ATPase reaction, from a round ring to a spiral and even to a pair of twisted half-spirals. HS-AFM observations of Walker-motif mutants unveiled crucial roles of ATP binding and hydrolysis in the oligomer formation. Furthermore, repressed and hyperactive mutations resulted in significantly different oligomeric forms. These results lead to a comprehensive view for the ATP-driven oligomeric-state transitions that enable ClpB to disentangle protein aggregates.

Visiting Associate Professor
YAMADA, Teppei *(from Kyushu University)*

Ionic Motion in Soft Molecular Space

Dynamics of ionic species are affected by the surrounding intermolecular interaction, Madelung potential as well as the external electric field. We intended to control the intermolecular interaction of ions in the molecular scale by designing the molecular assembly. To date, the phase transition of the rotating mode of tetraethylammonium in plastic crystal phase was investigated (*J. Am. Chem. Soc.* 291–297 (2018); *Chem. Lett.* 497–499 (2018)). Ionic motion in the ionic crystal was also applied as an electrolyte of thermocell (*Chem. Lett.* 261–264 (2018)). Recently we focus on the ionic motion in chiral nanospace. A porous metal–organic framework, Labtb, was synthesized with an enantioselective method. After the collaborative work with Prof. Okamoto and Dr. Narushima in IMS, high enantiomer-excess of Labtb in particle-level was visualized by circular dichroism imaging (a paper to be submitted). The obtained enantiomeric Labtb is highly stable from heat, chemicals and has 1D pore of *ca.* 13 Å in diameter, and we are searching the wide application of it.