Visiting Professors

Visiting Professor
AWAGA, Kunio *(from Nagoya University)*

Research on Organic Radical Materials

Organic radicals are key materials in both solid-state and solution redox processes. Organic radical solids always exhibit semiconductive behavior, due to electrostatic repulsion between unpaired electrons and/or electron-lattice interactions. This strongly suggests a potential application of organic radicals to organic electronics. We are performing fundamental research on electrical and magnetic properties of organic radical solids and application research on photo- and current-induced phenomena. We are also working on solid-state electrochemistry of insoluble self-assembled organic thin-films and transition metal complex clusters, targeting rechargeable batteries, functional electrodes, and electrochromic devices.

Visiting Professor
NAKAZAWA, Yasuhiro *(from Osaka University)*

Construction of a Low-Temperature Calorimeter Equipped with a Dilution Refrigerator

Organic conductors, Organic magnets, and metal complexes are fascinating materials which give various interesting electronic phases at low temperatures. The electron-phonon interactions, electron correlations in low-dimensional lattices have been widely investigated in them. With a purpose of studying these subjects and finding novel electronic behaviors, we are developing a new thermal-relaxation calorimeter for measuring heat capacity at extremely low-temperature region. The dilution refrigerator available under magnetic fields up to 16 T in the instrument center of IMS is utilized to get low-temperatures condition. The minimum temperature reached without sample cell was 21 mK and the cooling power at 100 mK was confirmed as 400 μW. A chip-type resistance containing ruthenium-oxide thick film was calibrated against standard thermometer and it was mounted on the Ag-based calorimetry cell. The heat capacity of tiny single crystals with typical weight of 50–300 μg can be measured with absolute precision in this temperature region. The microchip calorimetry devices obtained by the micro-fabrication technique will be installed in the dilution refrigerator in order to study μg class single crystal samples with high resolution.

Visiting Professor
SEKIYA, Hiroshi *(from Kyushu University)*

Spectroscopic Study on Intermolecular Interactions and Dynamics in Hydrogen-Bonded Clusters and Coordination and Solvation Structures of Transition Metal Ions

We investigate structures, intermolecular interactions, and multiple-proton/hydrogen transfer reactions in hydrogen-bonded clusters such as 7-azaindole(alcohol)$_n$/(water)$_n$ (n = 1–3) in the gas phase to clarify multi-dimensional potentials and the tunneling effect by combining electronic and IR spectroscopy with high-level quantum chemistry calculations. These studies provide specific features of multiple-proton/hydrogen transfer reactions that are different from single- and double-proton trasfer reactions. We also investigate the coordination and solvation structures of transition-metal ions. $Ag^+(NH_3)_n$ and $Ni^+(NH_3)_n$ are studied by infrared spectroscopy and quantum chemical calculations. Ag^+ and Ni^+ adopt tetrahedral and square-planar coordination, respectively. The results demonstrate a close relationship between the d-electron configurations of the metals and the geometric structures of the solvated complexes.