Kawaji Lab

Elucidation of Phase Transition and Function of Materials

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- Elucidation of giant particle size effect and its control and utilization
- Phase transition properties of molecules absorbed in Metal-Organic Frameworks
- Development of thermal conductivity switching materials

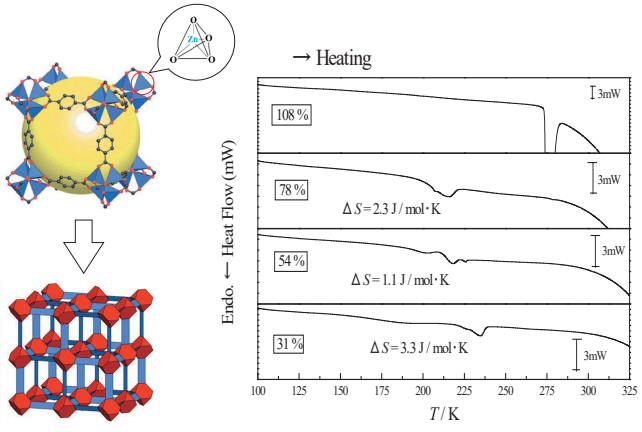
We aim to create novel functional materials by understanding the properties of various functional materials and by clarifying the details of the atomic/molecular motion of substances and the correlation between structure and physical properties by utilizing thermal measurement techniques. Our research method are focused on calorimetric measurements such as heat capacity measurements with the world's highest precision adiabatic calorimeter and other thermal property measurements such as thermal expansion measurements, besides dielectric constant, magnetic susceptibility, and X-ray/neutron scattering experiments, etc.

The strong point of our lab is that various thermal measurements can be carried out according to the purpose. For example, the heat capacity can be measured by the world's highest precision adiabatic calorimeter, a Quantum Design PPMS relaxation calorimeter for the low-mass sample (~10 mg), and a home-made calorimeter under a ultralow temperature and strong magnetic field environment using a dilution refrigerator. We also conduct and develop other thermal measurement system, such as the ultrahigh precision thermal expansion measurement device, thermal conductivity measurement system.

Adiabatic calorimeter

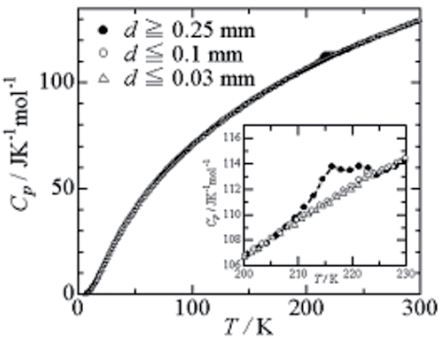
Phase transition properties of molecules absorbed in Metal-Organic Frameworks (MOF)

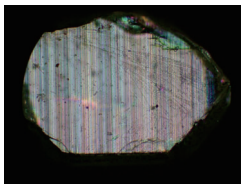
- The molecules absorbed in the MOF exhibit a phase transition behavior which is significantly different from the bulk.
- Evolve the elucidation of the absorption mechanism of various gases in the storage at low temperature.



Mechanism elucidation of giant particle size effect and its control and utilization

- We have discovered the giant particle size effect that appears with millimeter scale.
- Provide the new way for controlling the ferroelectricity by using the size effect.





Development of thermal conductivity switching materials utilizing metal-to-insulator transition (MIT)

- We have found the material with the highest thermal conductivity change among MIT materials.
- Aim for the application as the thermal conductivity switching material that dynamically functions against temperature change