

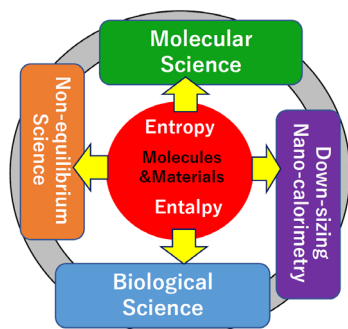
# Research Center for Thermal and Entropic Science

## Introduction

Materials necessary for our life and society are condensed systems of numerous number of atoms and molecules which have various microscopic degrees of freedom with quantum mechanical origins. These microscopic freedoms leads to a variety of physical phenomena through various inter-molecular interactions. These materials are treated as thermodynamic systems in natural science. Furthermore, when we discuss nature and functionalities of a small number of molecules, it is necessary to consider thermodynamic factor influenced by their environment. Here also discussions of thermodynamics are required. Studying macroscopic phenomena from the standpoint of their microscopic origins through the frameworks of thermodynamics and static physics is fundamental method of natural science.

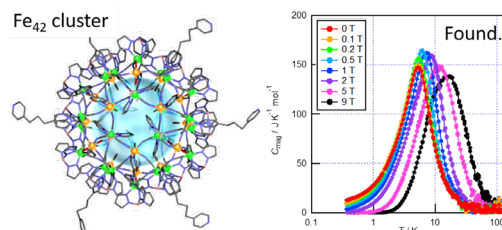
This center aims at understanding nature of materials hierarchically from the above viewpoints by performing precise experimental measurements of thermodynamic quantities such as entropy, enthalpy and Gibbs energy. Downsizing of the measurement systems and developing new measurements under various external environmental conditions are also the purpose of our research. This is a fundamental research center of thermal science with extremely unique characteristics that promotes the development of new substances and the development of new phenomena.

The center has various distinctive measuring apparatus and devices with their experimental and analytic techniques. The phase relation and thermal excitations of various molecular assemblies, for example, molecular magnetics, molecular superconductors, spin clusters, single molecular magnets, liquid crystals, and glasses etc. We also develop thermal science for various non-equilibrium systems such as biomolecules of proteins, enzymes, nucleic acids, polymers, solutions, nano-structure materials, etc. Collaborative researches with domestic and overseas institutes are underway.

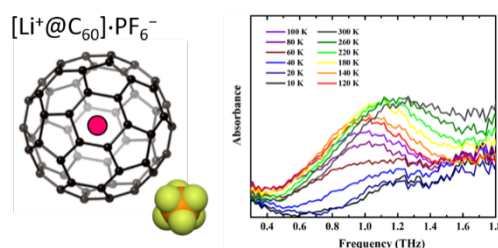


## Research Projects

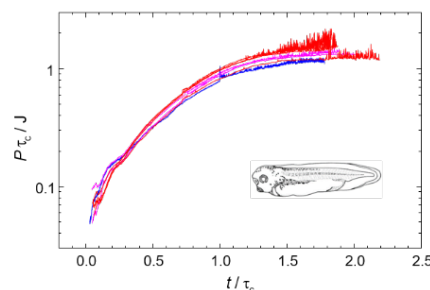
1. Thermodynamic investigation of molecule-based magnets.



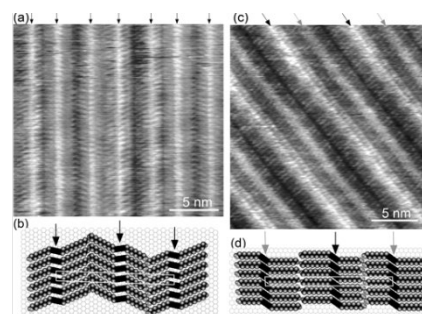
2. Motions of loosely bound atoms and molecules in Crystal



3. Thermodynamic approach to biological phenomena.



4. Structure and thermodynamics of two-dimensional solids formed at various interfaces.



5. Thermochemical approach to chemical bonds.

### The History and Future Scope of the Center

The “Chemical Thermodynamics Laboratory” was founded in 1979 by Prof. Syûzô Seki to study various physicochemical problems including phase transitions, critical phenomena and molecular energetics. In 1989, this center was succeeded by the “Microcalorimetry Research Center” to expand the project to wider area. The “Research Center for Molecular Thermodynamics” was founded in 1999 to explore thermodynamics of functional molecules and it was succeeded by “Research Center for Structural Thermodynamics” from 2009. In 2019, “Research Center for Thermal and Entropic Science” was founded to perform another ten years project by focusing on fundamental understanding materials and developing new materials and new phenomena occur in multi-scales in nature. The aim of the center is to dedicate to fundamental science based on accurate measurements of enthalpy and entropy. International collaboration is also significant task of the center.

**1979-1989**

**Chemical Thermodynamics  
Laboratory**

**1989-1999**

**Microcalorimetry  
Research Center**

**1999-2009**

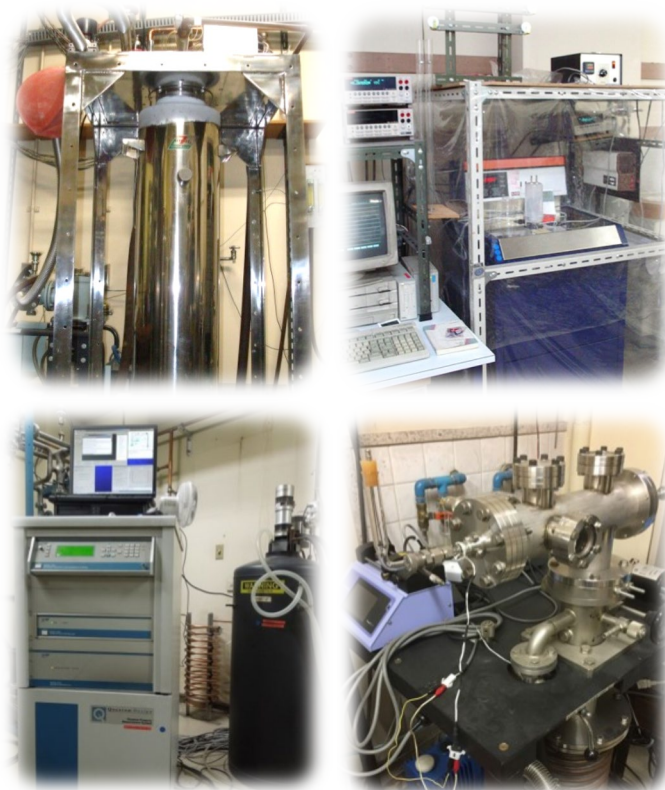
**Research Center for Molecular  
Thermodynamics**

**2009-2019**

**Research Center for Structural  
Thermodynamics**

**2019—**

**Research Center for Thermal  
and Entropic Science**



### Organization of the Center

