A Study on Laser Microchemistry

Focusing on the unique interactions between molecular systems and focused laser light under an optical microscope, this study explores the following three research topics.

1. A Study on Supercooled Liquids Based on Laser Trapping – Microspectroscopy of Single Aerosol Droplets

We have already shown that single aerosol droplets in air can be manipulated and interrogated based on a laser trapping – microspectroscopy technique in the temperature (T) range of 30 ~ –60 ºC. In particular, we have revealed that aerosol microdroplets are very likely to form a supercooled liquid below the freezing temperature of a bulk liquid system. In the present study, we study the physical properties (viscosity, dielectric constant, acid/base dissociation constants, and so forth) of various supercooled aerosol microdroplets on the basis of a laser trapping – microspectroscopy (fluorescence and Raman spectroscopies) technique.

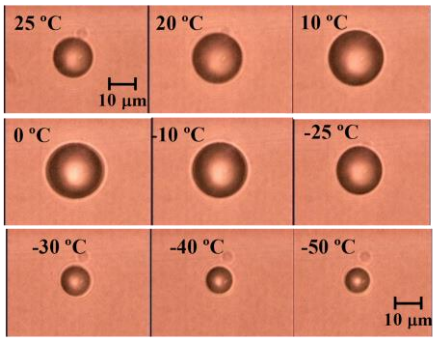

Figure. Laser-trapped aerosol water droplets in air at several temperatures.

2. A study on Mechanochemical Phenomena of Transition Metal Complexes Based on a Pulsed Laser Shock Wave (PLSW) Method

For quantitative discussion on mechanochemical phenomena, we employ a laser-induced shock wave generated by pulsed laser irradiation to a solid substrate: PLSW. On the basis of this particular PLSW method, we will study mechanochromic luminescence of solid transition metal complexes.

3. Simultaneous Extraction and Detection of Single Molecules Based on Laser Trapping Microspectroscopy Technique

Focused continuous-wave 1064-nm laser irradiation to an aqueous poly(*N*-isopropyl acrylamide)/alcohol solution under an optical microscope can produce single microparticles with a picolitter-level volume. In the presence of an analyte in the solution, the analyte can be extracted to the microparticle produced by laser irradiation. In the present study, we explore simultaneous extraction and detection of an analyte in the solution at a single molecular level.