

Invitation Report

Seminar 1

Speaker: *Prof. Tadafumi Adschiri*, Tohoku University, Japan

Topic: Supercritical Fluid Technology for Green Materials

Time: 15:30~17:00 (pm) August 25, 2011 (Thursday)

Place: Room 308, IPE Mansion

Abstract

Supercritical fluids technology is expected to contribute for new materials synthesis with the green sustainable chemistry route, especially for nanomaterials. So far, variety of materials have been developed, including ceramics, metals and polymers, but recent needs in the industries are of multi-functions of ceramics/metals and polymers to contribute for sustainable society. Composite materials might solve the problems, but in many cases trade-off of the functions are of important issues. To overcome the trade off, control of the nano-interface is the key, but nanoparticles are easily aggregated in polymer matrix because of the higher surface energy of NPs, and thus it has been considered a difficult task. Organic functionalization of inorganic nanoparticles is required to have higher affinity between NPs and polymers. The organic modification, NPs should be dispersed in an organic solvent with high concentration, which is difficult. for fabricating multi-functional materials, we proposed a new method to synthesize organic modified nanoparticles (NPs) in supercritical water. Since the organic molecules and metal salt aqueous solutions are miscible under the supercritical state, and water molecule works as an acid/base catalyst for the reactions, organic-inorganic conjugate nanoparticles can be synthesized under the condition. The hybrid NPs show high affinity with the organic solvent or the polymer matrix, which leads to fabricate the organic inorganic hybrid nanomaterials with the compatible (trade-off) functions, which contributes for green sustainable society.

Seminar 2

Speaker: *Prof. Motonobu Goto, Kumamoto University, Japan*

Topic: **Reaction and Material Processing by Pulsed Power Technology in Supercritical Fluid**

Time: 15:30~17:00 (pm) **August 26, 2011 (Friday)**

Place: **Room 308, IPE Mansion**

Abstract

We have been developing novel reaction and material processing technologies using electric pulse power in sub- and supercritical fluid media, such as, discharged plasma, laser irradiated plasma, electrospinning, and microwave process. We have studied generation of pulsed discharge plasma in subcritical or supercritical fluids, such as carbon dioxide, water, or argon. Two-phase system, where liquid and supercritical fluid coexist, was also used as a media to generate discharge plasma. The discharge behavior was investigated in terms of breakdown phenomena. Fabrication of nano-structured materials has been developed by performing pulsed laser ablation of copper, gold, and silver plates in supercritical CO₂. The metal nano-structured particles were successfully generated with allowing the selective generation of clusters. Both surface of ablated metal plates and structure of nanoparticles were significantly affected by the changes in supercritical CO₂ density. Electrospinning is one of the simple methods to produce nano to submicron fibers using high voltage electric field. We conducted the experiment using a system of electrospinning in supercritical carbon dioxide. Various polymers such as polyvinyl alcohol (PVA) and polyvinyl pyrrolidone (PVP), were used as a fiber material. Microwave irradiation in subcritical water has been used for chemical reaction or extraction process. We used the microwave process to extract bioactive components from natural materials.