List of Dissertation Abstract (Environment and System Sciences　Materials System Course)

Name	Supervisor	Title	Abstract
Takuya ISOSU	Atsushi SUZUKI	Fabrication and Characterization of Poly(vinyl alcohol) Gels in Tubular Shape Using Unidirectional Freezing Method	One way of preparing poly(vinyl alcohol) (PVA) gels is unidirectional freezing method, and gels prepared by this method is called unidirectional freeze-thawing gels (UFT gels). UFT gels have fibrous structures in the freezing direction, and it is reported that the tensile strength in the direction parallel to the fiber is high. In this study, we fabricated UFT tube gels by unidirectional freezing method and aimed to prepare samples showing the same tensile strength as UFT sheet gels.
Yusuke AKAHORI	Yoshimi TANAKA	Buckling and tearing of elastic thin sheet in low space	When tearing the paper by hand, insert a cut with scissors and pull left and right on the desk. At this time, the center of the paper buckles. It has been found that when this operation is performed in a space having a height of a few millimeters, buckling is　suppressed and a wrinkled pattern is formed. In addition, it is also found that the load required for tearing at this time is significantly increased as compared to the case without restraint. In this study, we prepared several types of paper with different thickness for the above phenomenon, and aimed to understand the mechanical and geometrical mechanism through tearing experiment and numerical analysis.
Keita ADACHI	Kenji ARAMAKI	Formation of Wormlike Micelles by Using Isosorbide Surfactants and Effects of Temperature and Concentration on the Solution	Isosorbide is a renewable resource derived from cornstarch, which attracts attention because it has been applied to as medicines etc. In this study, we used the surfactant sinthesized from isosorbide and tried to make wormlike micelles, which is useful for thickening toiletry, by it. Also, we investigated the effects of changing temperature and concentration on the wormlike micelle solution.
Masakazu IKAI	Akihiko ITO	Preparation of MgO–$MgAl_2O_4$–Al_2O_3 and MgO–SiO_2 nanocomposite films by metal-organic chemical vapor deposition	Materials in MgO–$MgAl_2O_4$–Al_2O_3 and MgO–SiO_2 systems have excellent chemical stability, mechanical properties, electrical characteristics and optical properties. In the present study, MgO–$MgAl_2O_4$–Al_2O_3 and MgO–SiO_2 nanocomposite films were prepared by metal-organic chemical vapor deposition (MOCVD). The effects of deposition conditions on the phase composition, orientation, and microstructure were investigated.

Yumi IMOTO	Junichi TATAMI	Mesoscale fracture properties of SiC measured by microcantilever method	I measured the fracture characteristics of the constituent elements of SiC and clarified the correlation between microstructure factor and fracture properties of SiC. SiC is composed of crystal grains, grain boundaries and amorphous phase of μm size, and the fracture properties of these constituent elements dominate the fracture property of SiC bulk body. In this study, the fracture characteristics of the constituent elements were actually measured using the microcantilever method which can measure the fracture characteristics of the desired region. As a result, it was possible to measure a value close to the theoretical strength of the component. The correlation between the microstructure factor and fracture properties could be clarified using the measured strength.
Chikahiro IWATA	Kenji ARAMAKI	Evaluation of formation of reverse wormlike micelle by measurement of ionic conductivity	Surfactants form various self-assembly structures in solution. The one of them is called a reverse wormlike micelle used as oil thickener. However the cost of formation of it was high and the thickening effect is low. We achieved the formation of the reverse wormlike micelle which solves the problems. Also we detected the correlation between the viscosity and ionic conductivity of solution.
Atsushi UGA	Motoyuki IIJIMA	Design of inorganic porous body using polymer monolith as a template and its application to plasmonic device	We fabricated the process of porous body controlling hieratical structure which consists of shapes, micro- and nano-scale pores and microstructure and applied to high value added plasmonic devices. Using this process, TiN porous body was fabricated and succeeded in application to photothermal conversion material for heating water and Surface Enhanced Raman Scattering (SERS) material for detecting signal of small amount organic matter. TiO2 porous body loaded Ag nanoparticle was also fabricated in same process and succeeded in application to integrated substrate of SERS sensing element for detecting signal of low concentration and low amount organic matter.
Yuya OZAWA	Akihiko ITO	Self-oriented growth of Y_2O_3 films using MOCVD	Yttria (Y_2O_3) films were prepared by metal-organic chemical vapor deposition (MOCVD). The effects of deposition conditions and substrates on film microstructure and orientation were investigated. Single-crystalline (100) Y_2O_3 films can be prepared on (100) YSZ substrate at deposition temperature of 1473 K and total chamber pressure of 0.8 kPa.

Kenji KAJII	Junichi TATAMI	Influence of particle accumulation structure of powder compacts on sintering shrinkage behavior of YSZ and porous NiO/GDC	Ceramics are prepared by shaping raw material powder and sintering them. Since there is a possibility of cracking or deformation during sintering, control of sintering behavior has been required. However, the relationship between the structure of powder compact and sintering behavior has not been sufficiently elucidated. Therefore, we aimed to elucidate the relationship by fabricating powder compacts with different structure and comparing sintering behaviors. As a result of observation and evaluation of powder compact at the microscale, it became clear that the type and arrangement of the particles in contact with each other in powder compact dominates sintering shrinkage behavior.
Fumika SAKAMOTO	Junichi TATAMI	Internal structure observation of ceramics by optical coherence tomograph ~Non destructive inspection and operand observation of sintering process~	Ceramics is a high-strength material, but the problem is that strength decreases due to the presence of defects. Therefore, the purpose of this research is to perform nondestructive inspection of defects by optical coherence tomography (OCT) which is a novel observation method for predicting the strength of ceramics and to clarify the phenomena that occurred by operand observation of the sintering process in which defects become obvious. As a result, the predicted strength based on the OCT observation agreed with the measured strength. In addition, we could grasp the shrinkage behavior with sintering quantitatively and understand the change of internal structure.
Yuka TSUNASHIMA	Mahito ATOBE	Electrochemical properties of highly concentrated aqueous electrolyte solutions and their application to organic electrochemical reactions	Organic electrochemical reaction in aqueous electrolyte solutions is a clean and environmentally-friendly process. However, water electrolysis occurs preferentially when electrochemical reaction is carried out in an aqueous electrolyte. On the other hand, Liumin Suo et al. reported in very recently that a highly concentrated aqueous electrolyte solutions expanded potential window. Under these backgrounds, in this study, we aimed to use this highly concentrated aqueous electrolyte solutions for organic electrochemical reactions. We have successfully demonstrated that a highly concentrated aqueous electrolyte is extremely useful for efficient organic electrochemical syntheses and effective electrochemical detection of bio-relating substances without interference of water electrolysis.

Kenta HASEGAWA	Motoyuki IIJIMA	Fabrication of Si3N4 ceramics with complicated structure using novel in-situ solidification process of multi-component non-aqueous dense slurry	Development of a shaping process of multi-component non-aqueous dense slurry into complexed structures without forming strong aggregates should open a new window toward fabrication of Si3N4 ceramics having complicated structures and reliable properties. Herein, we report a novel in-situ solidification process of non-aqueous dense slurry stabilized by our originally designed polymer dispersant; a complex of polyetheleneimine and oleic acid (PEI-OA). A small amount addition of multi-functional acrylates in this slurry achieved heat induced in-situ solidification by inter-particle crosslinking by Michael additive reaction between free amines of PEI-OA and acrylates.
Takashi HARA	Atsushi SUZUKI	Study of preparation method of dual crosslinked poly(vinyl alcohol) hydrogels	Poly(vinyl alcohol) hydrogels can be classified by the crosslinking methods into two types of physically crosslinked hydrogels and chemically crosslinked hydrogels. Chemically crosslinked hydrogels does not elute polymer. Physically crosslinked hydrogels has superior mechanical strength as compared with chemically crosslinked hydrogels but shows the polymer elutions. In this study, we investigate the preparation method for making dual crosslinked hydrogels with characteristic of both crosslinking methods.
Tomohiro HARA	Akihiko ITO	Yb-silicates fiber coating using metal-organic chemical vapor deposition	SiC fiber-reinforced ceramic matrix composites (SiC-CMC) is a candidate heat resistant material for aero engines. In the present study, Yb-silicates coatings were prepared on SiC fiber bundle using metal-organic chemical vapor deposition (MOCVD) for optimizing fiber-matrix interfaces to demonstrate a damage tolerant SiC-CMC.
Masaki HIYAMA	Mahito ATOBE	Anodic substitution reaction of tetrahydropyran by using a flow microreactor	In this study, anodic cyanation of tetrahydropyran, which is a 6-membered ring ether and has a high oxidation potential, was carried out by using a electrochemical flow microreactor. This simple synthetic method enabled to provide a useful 2-cyanotetrahydropyran although its yield was still low. It can be stated that this study offers a new method for synthesis not only of a useful 2-cyanotetrahydropyran but also of other substrates which have high oxidation potentials.
Ryosuke HORIE	Kenji ARAMAKI	Possibility of O/I1 type organic phase change material as a thermal storage material	A thermal storage material composed of an organic phase change material (PCM) attracts attention. However, leakage is a problem because organic PCM liquefies above the melting point. Therefore, O / I1PCM in which organic PCM is dispersed in cubic liquid crystal (I1 phase) was prepared and the possibility as a non-fluid type heat storage material is studied.

Juri MINOSHIMA	Mahito ATOBE	Stereoselective Electrochemical Synthesis of *Z*-Alkenes from Alkynes Using a PEM Reactor	The semihydrogenation reaction, which converts alkynes to alkenes, is one of the most important and fundamental reactions in the manufacturing processes of bulk and fine chemicals. The Lindlar semihydrogeneation of alkynes is a long-standing synthetic transformation and still remains a privileged system. However, it uses toxic Pb additive and a large amount of quinoline. Under this background, we investigated the electrochemical hydrogenation of alkynes to *Z*-alkenes using a proton exchange membrane (PEM) reactor. As a result, we found that product selectivity in the hydrogenation can be controlled by the selection of noble metal catalysts and applied voltage.