Abstracts of Papers (2004)

Department of Mechanical Engineering

*nonmember

Observation of rapid solidification of deeply under cooled Si melts using electrostatic levitation, Tomotsugu AOYAMA, Paul-François PARADIS*, Takehiko ISHIKAWA* and Shinichi YODA*: Mat. Sci. & Eng. A., 375, pp. 460-463, 2004.

Spherical Sapphire single-crystal synthesis by aerodynamic levitation with high growth rate, Yasutomo ARAI*, Tomotsugu AOYAMA and Shinichi YODA*: Rev. Sci. Inst., 75, pp. 2262-2265, 2004.

Theory of cellular solidification and homogeneous nucleation from molar flux balance at a diffuse interface layer, Shigeo Kotake: J. Cryst. Growth, 266, pp. 289-296, 2004.

Deposition of titanium nitride thin films onto Ti-6Al-4V alloy substrates by magnetron DC sputtering, Tsutomu Sonoda*, Akira Watazu*, Kiyotaka Kato*, Tadashi Asahina* and Shigeo Kotake: Silicates Industrels, 69, pp. 173-177, 2004.

An Indicating, Leading Manipulator as a Good Hand at Teaching Strokes: A Mental-Image-Creation Support System,Y. Nomura, H. Kakehashi, T. Sugiura, H.Matsui, and N. Kato: Proceedings of 9th Annual International Conference ICCHP 2004 (Computers Helping People with Special Needs), LNCS3118, pp.703~712, 2004

A mental image creation support system was developed. The mechanical device of the system is a 3-DOF manipulator that is composed of a 2-DOF quadrilateral parallel-link manipulator and an arm-end actuator. A couple of servomotors drive a couple of upper links of the 2-DOF manipulator, and they control the arm-end position. The arm-end actuator is attached to the 2-DOF manipulator's arm-end: a servomotor controls the orientation of a knob attached to the servomotor axis. The person is assumed to pinch the knob by his/her fingertips. The position of the knob axis traces the strokes of the presented figures sequentially, and the orientation of the knob is controlled to indicate the orientation of the currently tracing point on the stroke. A couple of preeminent functions are embedded to the process: one is the indicating function, and the other is the leading function. That is, the knob indicates to the person with its orientation to which direction the arm end moves: the direction reflects the orientation of the ongoing stroke. And the translation of the knob leads the person along the strokes. The indicating/leading functions play complementary role. Thus, the person is able to perceive the position and the orientation of the strokes of presented images via somatic sensations of his/her fingertip. It is expected to be a good hand at teaching strokes and to be a visual alternative of the blind persons and a visual aid of lazy eye persons at creating mental images.

Practical Education Curriculum Focusing on Seminar Courses, Experiments, and Practical Works: MIE Curriculum, Yoshihiko NOMURA, Tadashi INABA, Koichi TSUJIMOTO, Naoki MARUYAMA, Shigeo KOTAKE, Takao MAEDA, Ryojun IKEURA, Yutaka TAKAHASHI, Norihiko KATO, Yutaka SAWAKI, Yasuyuki SUZUKI, Jippei SUZUKI, Masaru USAMI, Kazuki MIZUTANI, Seizo KATO: J.of Japanese Society for Engineering Education, 52(4), pp.7~13, 2004

The department of mechanical engineering, Mie University has developed a practical learning curriculum, called MIE curriculum, focusing on a lot of practical courses such as seminar courses, experiments, and practical works, and has put it into operation since 2001. Of the 63 courses offered by the department, 31 are practical ones. MIE curriculum can be given the status of the thoroughly enhanced version of that having been presented by the Japan University Accreditation Association (JUAA). It was confirmed that, compared with old curriculum, MIE curriculum is, especially, effective for the middle and lower level of students to improve their academic records.

Master-Slave System Characterized by Hybrid Kinesthetic Sense Presentation of Real and Virtual Force, Naoaki Tsuda, Norihiko Kato, Yoshihiko Nomura and Hirokazu Matsui: Trans. of Human Interface Vol.6, No.1, pp.75-86, 2004

To attain comfortable maneuverability with master-slave systems, force feedback systems have been studied in various ways. However, no reflective force is returned to the operators when the slave robot works in free space, and doesn't have any contacts with the objects, in this case. We sometimes intend the slave robot to be in or to come into favorite regions, and/or intend the robot not to enter dangerous regions. It is necessary to notify the operator of the slave robot's situation to meet the operator's intension. To make the notification more effective, the authors proposed a method to present the kinesthetic sense as a hybrid of a contact-caused real force and a virtual force. The virtual force reflects the slave robot's situation such as position and velocity, and the reflection helps the operator to maneuver the slave robot in the environment with the favorite and/or dangerous regions. This paper presents a design method of the proposed system, and confirms the effectiveness of the system through tele-operating experiments.

Study on Assistive Robot Manipulator for Arm Kinesitherapeutic Exercise, Taiga Usui, Norihiko Kato, Yoshihiko Nomura and Hirokazu Matsui: Transactions of Japan Society of Mechanical Engineers, Part C Vol.70, No.694, pp.1781-1794, 2004

Aiming at the reduction of therapist burden in rehabilitation exercises, the authors have developed a technology to make a robot manipulator to be an assistive worker in kinesitherapy rehabilitation exercises by physical therapists. As for the kinesitherapy exercises, there are an exercise to sustain and to increase the arm joint ' s mobile range, an exercise to strengthen the muscle power and muscle endurance, and an exercise to train the muscle coordination function. This paper described some key technologies for the robot-aided assistive system: (1) a method to implement the four kinds of kinesitherapy exercises, (2) methods to estimate physical parameters were explained. The effectiveness of these methods was clarified by the practical experiments with a patient manipulator and an able-bodied person.

Vibration control for an overhung roller in textile machine considering the stiffness of control device stand, Kazuki MIZUTANI, Kazumichi KATO*, Takayoshi FUJII* and YILI: Journal of Sound and Vibration, No.269, pp.765-780, 2004.

This paper treats a vibration control method, which can be used in textile machinery to reduce the unbalanced vibration of an overhung roller-motor system. To control the vibration of the overhung roller, a drive motor with a hybrid type vibration control device consisted with rubber springs and electromagnets is used. When the vibration control system is set up in the textile machinery for industrial use, the stand supporting the control system to the base may be assumed not to rigid but elastic. For a certain value of the elastic stand stiffness, the vibration control performance of the overhung roller becomes very low. In order to prevent this deterioration, a stiffness control achieved by a positive feedback of the displacement signal of the rubber spring is proposed, and the effectiveness of the stiffness control is confirmed by simulations and experiments.

Influence of elasticity of a control device mount on vibration control performance for an overhung rotor system, Kazuki MIZUTANI and Ryojun IKEURA: International Journal of Acoustics and Vibration, 9(2), pp.75-80, 2004.

This paper describes the influence of elasticity of control device mount on vibration control effects for an overhung rotor system. The overhung rotor is supported by a flexible bearing pedestal installed in four pairs of electromagnets, and PD control is performed in the system. These electromagnets give a flexible bearing the control force to effectively reduce unbalanced vibrations of the overhung rotor indirectly. When the vibration control system is set up in the rotating machinery for industrial use, a mount supporting the control system to the foundation may be assumed not to be rigid but elastic. The effect of stiffness and damping of the elastic mount on the vibration control performance is examined for an overhung rotor system by numerical simulations. The effect of mount elasticity on the vibration control for overhung rotor is discussed in detail by the parametric study.

Application of optimal regulator theory with Kalman filter to vibration control for overhung rotor system, Kazuki MIZUTANI, Takashi ITO*, Naohito DOI* and Ryojun IKEURA: Proceedings of The 11th International Congress on Sound and Vibration, pp.2041-2048, 2004.

This paper describes an active vibration control to effectively reduce the unbalanced vibration of an overhung rotor system. The optimal regulator theory with the Kalman filter is applied to decide the control gain suppressing the vibrations of the overhung rotor and the effective vibration suppression performance is shown. The numerical results are compared with experimental ones, and both results show the similar tendency in our study.

Optimal Vibration Control by LQR for Overhung Rotor System: [in Japanese], Kazuki MIZUTANI, Takashi ITO*, Naohito DOI* and Ryojun IKEURA: Trans. Japan Soc. of Mechanical Engineers, 70-700 C, pp.3406-3412, 2004.

This paper treats an optimal vibration control by LQR to effectively reduce the unbalanced vibration of an overhung rotor system. A vibration control device is installed between a driving motor and an overhang rotor. This control device consists of a simply supported rotor-shaft system, a rotor of which is installed in four pairs of electromagnets to supply a control force. Influence of weighting coefficients in the cost function for the optimal regulator theory is investigated, and the optimal feedback gains to give the effective vibration suppression performance are provided. For practical use, the simplification of the rotor model for controller design and the application of the Kalman filter are also examined. The simulated results and the experimental ones show the similar tendency.

Guidance of human by vibration stimulus [in Japanese], Ryojun IKEURA, Hirofumi YAMASHITA* and Kazuki MIZUTANI: Transaction of the Society of Instrument and Control Engineers, 40, 6, pp.679-689, 2004.

This paper describes the guidance of human being using two vibration motors. A human has the two vibration motors with eccentric weight in both hands. He/she turns right when the motor in the right hand vibrates and the motor in the left hand rests. Similarly, he/she turns left when the motor in the left hand vibrates and the motor in the right hand rests. For showing the effectiveness of the proposed method, the control method of the vibration motors is considered. Firstly, the rotational response of the human from the command signal of the vibration motor is investigated when he/she turns right or left with stamping his/her feet. The results show that the human can follow the rotational command

of 1.3Hz. Next, the rotational response with walking is investigated. It is shown that the rotational velocity of the human becomes high when the walking speed is high. Moreover, a peak is observed at 1.3Hz in the frequency response. Finally, the rotational characteristics of the human from the command signal of the vibration motor is modeled as ARX (Auto-Regressive eXogeneous) model and a P controller for making the human turn to a target direction is designed using a root locus. The effectiveness of the control method is shown by simulations and experiments.

Experimental Research on Mechanical Properties of a New TiNi Shape Memory Alloy, A. Hayashi, M. Tokuda, T. Inaba, K. Hashimoto: Key Engineering Materials, Vols.274-276, pp.1089-1094, 2004.

The shape memory alloy with a shape memory property and pseudo-elastic property has been noted as one of the most attractive smart materials. Especially, the TiNi shape memory alloy shows the high performance compared to other shape memory materials, and has additional excellent properties, for example, anti-erosion property, anti-abrasion property, anti-vibration property and so on. In these days, the Ti-Ni shape memory alloy has been applied in the engineering/industrial field. However, it is rather difficult to produce the homogeneous bulk material, and thus the provided TiNi shape memory material is mainly wire or plate, and thus its application is quite limited (for example, the antenna of mobile telephone, frame of eye-glasses and so on). Recently, our joint research group (university and industry) developed a new technology to produce the homogeneous bulk TiNi shape memory alloy by applying a sintering-powder technology. By using this technology, arbitrary shape of Ti-Ni shape memory material can be obtained in a high quality. In our laboratory, the thermo-mechanical property was confirmed experimentally, by using several loading processes: tension, compression, torsion, and combined loading process of thin-walled tube specimen. In this paper, the results are shown and discussed.

Experimental Research on Two-way Shape Memory Effect of TiNi Shape Memory Alloy, T. Kato, M. Tokuda, T. Inaba, M. Yamazaki: Key Engineering Materials, Vols.274-276, pp.1095-1100, 2004.

The two-way shape memory effect is expected as prospective property for new engineering applications of shape memory alloys. In this study, the two-way shape memory behavior obtained by the mechanical loading training was investigated experimentally. The obtained results are presented and discussed in this paper.

Analysis of In-Plane Elastic-Viscoplastic Behavior of Plain-Woven GFRP Composites Based on a Homogenization Theory, T. Matsuda, Y. Niyama*, N. Ohno*, M. Tokuda: Key Engineering Materials, Vols.274-276, pp.919-924, 2004.

Research on Deformation Characteristic of AZ31Mg Alloy and its Constitutive Equations, M. Mizutani, M. Tokuda, T. Inaba, S. Ikushima, S. Makino: Key Engineering Materials, Vols.274-276, pp.1101-1106, 2004.

Superplasticity of polycrystalline metallic materials is a phenomenon which shows hundreds to thousands of percents of large plastic deformation without necking in a steady state of low stress, when the uni-axial tensile loading is done in some special thermo-mechanical conditions (some limited ranges of properly high temperature and low strain rate). The main mechanism of superplastic phenomenon is the grain boundary sliding, while the main mechanism of usual plastic deformation is the trans-granular sliding. In this research, the possibility of superplastic deformation in a magnesium alloy (AZ31Mg alloy) was experimentally investigated, because generally speaking, the magnesium alloy whose atomic structure is hexagonal does not have enough formability in a form of trans-granular sliding mechanism. In this paper, the detail of experimental results are shown and discussed. Moreover, the constitutive equations of Mg alloy are proposed on the basis of the experimental results. These results may be useful for the engineering application of Mg alloy with ultra-light weight.

Mechanical Evaluation of Left Ventricular Contractility using Magnetic Resonance Tagging Technique [in

Japanese], Shingo Kawasaki*, Takuya Taniguchi*, Satoshi Asada*, Tatsuya Kawasaki*, Tadaaki Kamitani*, Hiroki Sugihara*, Tadashi Inaba, Yasutomi Kinosada*: Matsushita Medical Journal, Vol.43, No.1, pp.25-30, 2004.

Left ventricular contractility was investigated by analyzing deformations of the myocardial walls using a Magnetic resonance (MR) tagging technique. Subjects were 10 normal volunteers, 7 patients with hypertensive heart disease (HHD), 8 patients with hypertrophic cardiomyopathy (HCM) and 4 patients with left bundle branch block LBBB). In this study, circumferential strain was employed as an index for evaluation of contractility. Circumferential strain was calculated from the motions of the tagging stripes on short axis MR images. In controls circumferential strain was uniform in all regions. Circumferential strain in HHD was almost uniform over all regions similar to than in normal subjects. In contrast, circumferential strain in HCM was significantly smaller in the anteroseptal region than that in normal controls. In LBBB patients, circumferential strain in the septal wall demonstrated reverse values compared with those of other walls. Calculating circumferential strain could clarify left ventricular (LV) wall deformation as well as contractility.

Thoracolumbar Anterior Spinalinstrumentation [in Japanese], Takaya KATOH, Yuichi KASAI*, Tadashi INABA, Atsumasa UCHIDA*, Masataka TOKUDA: J. of Japanese Society for Clinical Biomechanics, Vol.25, pp.129-132, 2004.

Regarding thoracolumbar anterior instrumentation with dual rods system, there are a few reports evaluating mechanical effect of their rod diameter on the adjacent intervertebral disc. Biomechanical study was performed to examine the difference of mechanical effect by rod diameter between a 4.75mm (thin rod) and 6.35 mm (thick rod) rod in thoracolumbar anterior instrumentation. The internal pressure on the intervertebral disc between the fixed vertebrae as well as between the adjacent vertebrae was determined by applying a compressive load up to 500 N using 5 human cadaver thoracolumbar spines. The load applied on the screw was calculated by the strain on the rod. The results showed that the internal pressure between the adjacent vertebrae with the thick rod was a slightly higher than that with the thin rod. The load to the screw with the thick rod was a two times larger than that with the thin rod. Thus, the thick rod may have a possibility to produce instability between the adjacent vertebrae or risk of screw damage when compared with the thin rod.

Metallurgical Factors affecting Reheat Cracking in HAZ of Cr-Mo Steel, Koreaki Tamaki, Jippei Suzuki and Hiroshi Kawakami: Proceedings of Finnish—German—Japanese Joint International Seminar, pp.155-168, 2004

Reheat cracking occurs at about 800K. It is initiated at the stress-concentrating portion, such as the toe of bead. It arises in the heat-affected zone (HAZ) and propagates along the grain boundary of prior-austenite, which was the boundary of austenite grain given by the weld-thermal-cycle. In this document, the cracking sensitivity, the mechanism of cracking and the measures for prevention will be discussed on the Cr-Mo steels, such as high strength steels of 780MPa class (HT80) and the heat resisting steels of low-alloyed type.

One Approach for Bonding of Aluminum in Atmosphere, Hiroshi Kawakami: Journal of the Japan Welding Society, Vol.73, No.4, pp.246-249, 2004.

Simple bonding method for aluminum was explained in this paper. The increment of bonding temperature, pressure decrease the critical bonding time and the decrement of oxygen concentration also decreases that. In case of bonding pressure of 0.75MPa, it is shown that the bonding in the atmosphere can be carried out sufficiently by this bonding method.

Modeling for Deformation of Aramid Fiber Bundle During Machining Aramid FRP, Eitoku NAKANISHI, Yutaka SAWAKI and Kiyoshi ISOGIMI: Journal of Japan Society of Advanced Production Technology, Vol.22, No.1, pp.67-74, 2004

Recently, the composite materials are used very widely. However, the machining of composite materials is very difficult. Especially the machining of an Aramid fiber reinforcing plastics (A-FRP) causes the rough machined surfaces. For getting good surface finish in cutting of A-FRP, fiber in the material must be fractured at the point of contact with cutting edge. In this study, we observed behavior of fiber in dynamically during orthogonal cutting. And we simulated phenomena with a very simple model to evaluate the deformation of Aramid fiber bundle during cutting. It is based on Dr. Timoshenko's theory of beams on the elastic foundation. In this analysis, the beams are regarded as Aramid fibers and the elastic foundation is regarded as matrix material. Further, we extend the theory for deformations of Aramid fiber bundle. The calculated results show the characteristic deformation of Aramid fibers in practical cutting.

Morphological Control of Mesoporous Silica Materials with Self-organized Structure and Their Mechanical Properties, Akihito MATSUMURO, Yuuki SANADA and Yutaka TAKAHASHI: J. Jpn. Soc. Prec. Eng. 70, pp. 70-75, 2004

Mesoporous silica materials with self-organized structure that consists or periodic nano-scale pores have been expected to be of great significance in realizing micro-nano systems. The morphological control o the mesostructured materials are demonstrated by varying the concentration ratio o $CH_3(CH_2)_{15}N(CH_3)Cl$ (C16TMACl)/$(C_2H_5O)_4Si$ (TEOS) and HCl solutions. The increase of the concentration ratios changes the shape and size of the mesostructured materials. Linear hexagonal rods, good example of this applications, can be synthesized by the reaction of 7.04g/4.48ml for C16TMACl/ TEOS and 70ml/20ml for 5N HCl/H_2O. The most suitable calcinations conditions for higher strength are determined by varying the calcinations temperature up to 1000℃. The hardness, elastic modulus and fracture load of the mesostructures hexagonal rods are clarified by nano-indentation method.

Preparation and Morphology of FCC C_{60} Powder Grown by Liquid-Liquid Interfacial Precipitation, Yutaka TAHAHASHI and Katsuhiro ASAI: J. Jpn. Inst. Metals 68, pp. 326-332, 2004

C_{60} solid was grown by liquid-liquid interfacial precipitation (LLIP, Miyazawa *et al.*: J.Mater.Res.17(2002)83). Toluene and methyl alcohol were used as good and poor solvents, respectively. A defect-free fcc single phase was obtained. Optical and scanning electron micrographs revealed that the size of grains was typically up to a few μm. However, coarse grains about 10-100μm in size were mixed when ethyl alcohol was used. This is because nucleation and prolonged growth of the C_{60} solid also occurs on the inner wall of a glass bottle. The morphology of grains was examined using transmission electron microscopy. The micrograms indicate that the {111} and {200} planes of the fcc structure are crystal habits that preferentially develop in solution. The morphology is thermodynamically stable as observed in a sample prepared by the sublimation-recrystallization method, thus, it is suggested that grains in the LLIP method grew under near equilibrium conditions.

Measurement of Pressure Distribution on Rotating Blade of Field Horizontal Axis Wind Turbine, Takao MAEDA, Hideyuki KAWABUCHI, Yukimaru SHIMIZU, Albert BRUINING*: Trans of JSME, Series B, Vol. 70, No.693, pp. 119-125, 2004.

Wind Tunnel Study of the Interaction between Two Horizontal Axis Wind Turbine, Takao MAEDA, Takeshi

YOKOTA, Yukimaru SHIMIZU, Kazuhiro ADACHI: Wind Engineering-the international journal of Wind Power, Vol. 28, No. 2, pp. 197-212, 2004.

Estimation of Generation Power of Wind Turbine due to Doppler SODAR Assessment, Takao MAEDA, Miwa NAKANO, Yukimaru SHIMIZU: Trans of JSME, Series B, Vol. 70, No.696, pp. 2026-2033, 2004.

Performance of the Torque Control of a Traction Drive in a Small Scale HAWT, Yasunari KAMADA, Edmond ISMAILI, Takao MAEDA, Yukimaru SHIMIZU, Kazuma YAMANAKA, Tomohiro MAKINO*: Proceedings of the World Wind Energy Conference and Renewable Energy Exhibition, CD-ROM, 2004.
Effect of Complex Terrain on Vertical Wind Profile Measured by SODAR Technique, Takao MAEDA, Shuichiro Homma and Yoshiki ITO: Wind Engineering-the International Journal of Wind Power 2004, Vol. 28, No.6, pp. 667-678, 2004.

WIND TUNNEL STUDY OF THE FLOW FIELD AROUND THE BLADE OF A HAWT, Takao MAEDA, Yasunari KAMADDA, Yusaku SAKAI, Naoki TAKAHARA: Proceedings of European Wind Energy Conference & Exhibition 2004, CD-ROM, 2004.

Research and Development of Wind Energy at Mie University, Takao MAEDA: Proceedings of the Annual Meeting of Korea International Conference on Fluid Machinery, CD-ROM, 2004.

Wind tunnel study of pressure distribution on a rotor blade of horizontal axis wind turbine, Takao MAEDA, Yasunari KAMADA, Yusaku SAKAI, Koutaro SUGI: Proceedings of JSME annual meeting 2004, No.04-1, Vol.2, pp.133-134, 2004.

Development of a micro gate-type hydroelectric generation system, Takao MAEDA, Yasunari KAMADA, Hideaki SASAKI, Yoichi YAMADA: Proceedings of JSME Fluids Engineering division annual meeting 2004, CD-ROM, 2004.

Studies on development of airfoils for wind turbines (Change of the airfoils performance due to angle of attach changes), Takao MAEDA, Yasunari KAMADA, Atsushi KAWAMURA, Shingo SUZUKI: Proceedings of JSME Fluids Engineering division annual meeting 2004, CD-ROM, 2004.

Development studies on a horizontal axis wind turbine with micro passive pitch-flap mechanism, Takao MAEDA, Yasunari KAMADA, Takayuki KATO, Hiroshi TAMURA: Proceedings of 26th Wind energy utilization symposium, pp151-154, 2004

Life Cycle Considerations of the Flue Gas Desulphurization System at a Lignite-Fired Power Plant in Thailand, Sate

Sampattagul, Seizo Kato, Tanongkiat Kiatsiriroat* and Anugerah Widiyanto: Int J LCA, Vol.9, No.6, pp.387-393, 2004

The Flue Gas Desulphurization (FGD) system has been installed at the biggest lignite-fired power generation plant in Thailand to reduce the large amount of SO_2 emission. In order to understand the costs and benefits, both in ecological and economic terms, the lignite-fired plant was studied both before and after the installation of the FGD system. The focus of this study is to consider not only the Life Cycle Assessment (LCA) outcome but also the Life Cycle Costing (LCC) factors. The results can provide valuable information when selecting appropriate technologies to minimize the negative impact that lignite-fired power plants have on the environment. LCA is an important decision-making tool for environmental policies, especially with regard to the selection of pollution control equipment for lignite-fired plants. Green coal technologies and strategies to reduce the negative impact on the environment are essential to produce more environmentally-friendly power plants with a sustainable future.

Development of Decision Model for Selection of Appropriate Power Generation System Using Distance Based Approach Method, Anugerah Widiyanto, Seizo Kato and Naoki Maruyama: JSME International Journal, Ser. B, Vol.47, No.2, pp.387-395, 2004

For solving decision problems in electric generation planning, a matrix operation based deterministic quantitative model called the Distance Based Approach (DBA) has been proposed for comparing the technical-economical and environmental features of various electric power plants. The customized computer code is developed to evaluate the overall function of alternative energy systems from the performance pattern corresponding to the selected energy attributes. For the purpose of exploring the applicability and the effectiveness of the proposed model, the model is applied to decision problems concerning the selection of energy sources for power generation in Japan. The set of nine energy alternatives includes conventional and new energy technologies of oil fired-, natural gas fired-, coal fired-, nuclear power, hydropower, geothermal, solar photovoltaic, wind power and solar thermal plants. Also, a set of criteria for optimized selection includes five areas of concern; energy economy, energy security, environmental protection, socio-economic development and technological aspects for electric power generation. The result will be a ranking of alternative sources of energy based on the Euclidean composite distance of each alternative to the designated optimal source of energy.

Practical Education Curriculum Focusing on Seminar Courses, Experiments, and Practical Works,: MIE Curriculum, Yoshihiko Nomura, Tadashi Inaba, Koichi Tsujimoto, Naoki Maruyama, Shigeo Kotake, Takao Maeda, Ryojun Ikeura, Yutaka Takahashi, Norihiko Kato, Yutaka Sawaki, Yasuyuki Suzuki, Jippei Suzuki, Masaru Usami, Kazuki Mizutani, Seizo Kato: J. of JSEE, Vol.52, No.4, pp.7-13, 2004

The department of mechanical engineering, MIE University has developed a practical learning curriculum, called MIE curriculum, focusing on a lot of practical courses such as seminar courses, experiments, and practical works, and has put it into operation since 2001. Of the 63 courses offered by the department, 31 are practical ones. MIE curriculum can be given the status of the thoroughly enhanced version of that having been presented by the Japan University Accreditation Association (JUAA). It was confirmed that, compared with old curriculum, MIE curriculum is, especially effective for the middle and lower level of students to improve their academic records.

The Decision –Making Tool for Power Generation Systems Improvement by Using LCA-NETS-GP Index Method,

Sate Sampattagul, Seizo Kato, Naoki Maruyama, Akira Nishimura, Tanongkiat Kiatsiriroat* and Anugerah Widiyanto: Abstracts of SETAC Europe 14th Annual Meeting, pp.198, 2004

The green productivity index from LCA-NETS point of view has been developed to concentrate not only LCA outcomes but also LCC influences. The goal of the research was to develop a decision-making tool which could reflect alternative improvement results of the power generation systems from both ecology an economy effects. The objectives of this study were to introduce LCA and LCC to the power generation plants and build up the green productivity model as the decision-making tool for the selective improvement techniques of power generation systems. The newly proposed LCA-NETS (Numerical Eco-Load Total Standardization) is used to evaluate the environmental burdens by identifying and quantifying the inputted energy and materials and outputted wastes released to environment through the life cycle of each power plant. The impacts due to the global and regional environmental issues are numerically evaluated in NETS. As the result, it could be shown that the LCA-NETS, LCC and green productivity index have potential to be the decision-making tool for power plants alternative improvement selections and discussed for more environmental friendly society in the future.

Environmental Impact Assessment of Independent Co-generation Systems using LCA Method, Naoki Maruyama , Yucho Sadamichi , Anugerah Widiyanto , Seizo Kato and Akira Nishimura: Proceedings of 2nd International Energy Conversion Engineering Conference, CD-ROM, 2004

To analyze the impact on the environment due to industrial activity and our daily living, the energy supply and demand are clearly an essential point within energy development. The Life Cycle Assessment (LCA) is the most suitable method for evaluating the environmental impact resulting from the activity through the lifecycle. This study provides an LCA scheme of distributed power supplies for electricity and heat demands, which uses various kinds of fuels including natural resources and co-generation systems. The NETS (Numerically Eco-load Total Standard) concept, which is proposed by the authors, is used for a numerical standardization measure to evaluate their environmental impacts. This evaluation method will be able to treat the environmental issues such as the depletion of natural resources, global warming due to CO_2 emissions, destruction of the ozone layer, air and water pollution, acid rain and waste disposal. This LCA scheme, including the cost estimation, is applied to co-generation energy systems. The LCA scheme and the software developed in this study could be useful for further development of sustainable eco-energy supply systems.

Life Cycle Analysis for Electricity Grid Systems in Japan, Anugerah Widiyanto, Naoki Maruyama and Seizo Kato: Proceedings of 2nd International Energy Conversion Engineering Conference, CD-ROM, 2004

Recent years have seen an upsurge of interest in life cycle assessment (LCA) as a tool for evaluation of potential environmental impacts of any industrial activity. It is often found that the main environmental impact is generated from electricity consumed, e.g., during manufacturing and usage stage of industrial products. In Japan, 10 electric companies supply electricity to the entire region. Therefore, in this study, the life cycle inventories for the 10 electricity companies in Japan were developed based on fiscal year 2002 data. The life cycle emissions were estimated for the systems using a combination of process analysis and input-output analysis. For the life cycle impact assessment (LCIA) method, the proposed LCA consolidated evaluation technique called LCA-NETS (Numerical Eco-load Total Standard) method is use d. As the result, the LCA evaluations are discussed for further ecological improvement.

High Yield CO_2 Conversion into CH_4 by Photocatalyst Multilayer Film, Akira Nishimura, Nobumasa Sugiura, Seizo Kato, Naoki Maruyama and Shinji Kato*: Proceedings of 2nd International Energy Conversion Engineering Conference, CD-ROM, 2004

Photocatalyst mass conversion of CO_2 into fuel-like species like CH_4, C_2H_4, C_2H_6 and CO is an attractive technique as the element of carbon cycle construction for CO_2 emission originated from fossil fuel combustion. Feasibility studies of photocatalytic conversion of CO_2 into fuel-like species have been performed, but their converted yields remain small within the order from 10 to 100 ppm. In order to promote the yield of CO_2 photocatalyst conversion into fuel, innovative techniques are needed first for TiO_2 film formation. In this paper, we propose a multilayer TiO_2 film coated on Cu substrate by a sol-gel and dip-coating ₜechnique. The film layer numbers are 1, 3, 7, and 11. The yield experiment of the photocatalyst film is carried out by using a cylindrical reactor. CO_2 gas saturated with H_2O vapor is filled in the reactor. The chemical species are detected by a gas chromatograph. Various kinds of film configuration are tested and their surfaces are observed by SEM and EDX. As a result, higher reforming concentration, energy efficiency, and quantum efficiency is acquired at larger film layer number since the activity of photocatalytic reaction is promoted with increasing film layer number. The higher progressive effect for CO conversion into CH_4 due to multilayer TiO_2 film is clarified. The innovative photocatalytic film having a high yield over 10800 ppm of CH_4 and 18000 ppm of CO for the CO_2 conversion into fuel-like species is realized with the aid of multilayer TiO_2 film coated on Cu substrate by a sol-gel and dip-coating technique. This high yield is marvelous compared with the other reports.

Photocatalyst Sol-gel Multi Layers Film for High Yield CO_2 Conversion into CH4, Akira Nishimura, Nobumasa Sugiura, Seizo Kato and Shinji Kato*: Proceedings of the 10th APCChE (Asian Pacific Confederation of Chemical Engineering) congress, CD-ROM, 2004

Photocatalyst conversion of CO_2 into fuel-like species like CH_4, C_2H_4, C_2H_6 and CO is an attractive technique for CO_2 re-use element of carbon cycles construction. Feasibility experiment of CO2 conversion by using TiO_2 photocatalyst mixed with several kinds of metals have been carried out, although the reforming concentrations seem to be relatively small within the order from 10 to 10^2ppm. In order to promote the yield of CO_2 photocatalyst conversion as much as 10^4ppm for re-use as fuel, innovative techniques are needed first for TiO_2 film formation. In this paper, we propose a new sol-gel and dip-coating on a copper metal substrate with multi-layers of TiO_2. In this experiment, the conversion yield by the photocatalyst film coated over a cylindrical reactor of Cu tube is examined, in which an UV lamp is set along the center line. CO_2 gas saturated with H_2O vapor is filled in the photocatalyst reactor. The conversion characteristics are tested by changing the number of TiO_2 film layer coated on the Cu substrate and the firing duration time. The chemical species are detected by a gas chromatograph at an interval of 24 hour. TiO_2 film surface are analyzed by SEM and EDX. As a result, film surfaces have been more roughness with increasing coating number and decreasing firing duration time. Compared with the previous studies, remarkably higher concentrations of exceeded 9000ppm for CO and 2300ppm for CH_4 have been obtained. It is known that CO is produced earlier than CH_4, C_2H_4 and C_2H_6.

Environmental Impact Assessment of Electricity Generation Systems, Naoki Maruyama, Sate Sampattagul and Seizo Kato: Proceedings of the 11th Tri-University International Joint Seminar & Symposium 2004, pp.85-90, 2004

It is often found that the serious environmental load is generated from electricity consumed, e.g., during manufacturing and usage stage of industrial products. The Life Cycle Assessment (LCA) is the most suitable method for evaluating the environmental load resulting from the numerical measure to estimate the quantitative impact of any industrial activity on the environment is introduced. For the life cycle impact assessment method, the proposed LCA consolidated evaluation technique called LCA-NETS (Numerically Eco-Load Total Standard) method is used. This

evaluation method will be able to treat the environmental issues such as the depletion of natural resources, global warming due to CO_2 emissions, ozone sphere destruction, atmospheric pollution, acid rain, waste processing, etc. The life cycle inventories for the 10 electricity companies in Japan are developed to estimate the environmental load of power generation systems. The environmental load of co-generation systems is also estimated for guiding to eco-operation (ecology conscious operation) because of their tight connection with the environmental loads and energy issues. As the result, the LCA evaluations are discussed for further development of sustainable eco-energy supply systems.

A Recyclable Hydrogen Gasifier without Power Supply, Junichi Suzuki, Tatsuya Shimizu, Akira Nishimura and Seizo Kato: Proceedings of the 11th Tri-University International Joint Seminar & Symposium 2004, pp.1-5, 2004

Today, global environmental problems such as air pollution, global warming, rain acidification, and fossil fuel depletion become serious due to mass consumption of fossil fuels. To solve these problems, hydrogen is good candidate for alternative energy source. When hydrogen is burned, exhaust is clear. However, effective procedure to produce and store hydrogen has not been constructed yet. Then, we propose the recyclable hydrogen gasifier that consists of metal and acid solution. By means of immersing metal in the acid solution and recycling metal with electricity, this gasifier is worked without power supply. Hydrogen can be stored safely and easily by separating metal and acid solution. In this study, we selected Zn plate and D_2SO_4 as metal and acid solution respectively. The gasifier experiment on hydrogen production rate was carried out with changing pH and temperature of D_2SO_4, and reaction area of Zn. As the result, hydrogen production flux has been decided by pH and temperature of D_2SO_4, and reaction area of Zn. The highest performance of 0.047 [g/(m^2·sec)] has been obtained at pH=0.55, 333K and reaction area of 1 [m^2]. In addition, we tried to reproduce Zn and acid solution by using the characteristic of Zn that is called hydrogen over voltage. Moreover, we have evaluated the reproduction efficiency. Chemical reproduction efficiencies under most conditions with fixing electrolysis voltage of 4.0 [V] and changing electrode size and temperature are over 90%.

Study on Energy Saving System in Fluid Transportation Using Blood Flow Characteristics, Koji Nagai, Akira Nishimura and Seizo Kato: Proceedings of the 11th Tri-University International Joint Seminar & Symposium 2004, pp.208-211, 2004

A blood circulation is one of the important functions for the ecological system. Thanks to this function, it is possible that a blood is circulated along the blood vessels, which are spread in the whole body, of about 0.1 million km length totally in the short time of 24 seconds by using the heart which is a small power pulse pump of 10W or less. We can imagine that a huge power pump is necessary for realizing the blood circulation artificially. Therefore, it can be said that the blood circulation carries out the high effective and ideal fluid transportation. There are three characteristic elements, which are pulse flow, non-Newtonian fluid, and elasticity tube, in the blood circulation. It is thought that these three elements contribute to the high effective and ideal fluid transportation. Consequently, we pay attention to these three elements. In this study, the effects of each element have been investigated by measuring pressure drop and analyzing tube characteristics. We would like to make a foothold by utilizing the results for constructing the more effective fluid transportation system.

Combined Hydrogen Gasifier and Storing Technique with the aid of Acid Water and Metal, Tatsuya Shimizu, Seizo Kato and Akira Nishimura: Proceedings of 41st National Heat Transfer Symposium of Japan, Vol. I, pp.71-72, 2004

The fossil fuel depletion and the CO_2 warming due to the combustion are becoming serious environmental issues. Hydrogen is to be a best candidate for alternative energy resources friendly to the environment. This work aims at proposing an innovative type of hydrogen production process from acid water by immersing an electrode metal, in which both acid water and electrode metal are able to be well recycled. In the experiment, D_2SO_4 as an acid aqueous solution and Zn plate as an electrode are selected. The hydrogen gasifier has so a fairly good performance that the hydrogen production rate reaches to ～0.05g/s per unit electrode area of $1m^2$ from the acid water having a pH of 0.55 and a temperature of 60℃. Additionally, the dissolved Zn to the acid water can be well regenerated at a high recovery efficiency of ～95%.

Environmental Impact Assessment of Independent Co-generation Systems using LCA Method, Naoki Maruyama, Yucho Sadamichi, Anugerah Widiyanto, Seizo Kato and Akira Nishimura: Proceedings of 41st National Heat Transfer Symposium of Japan, Vol. II, pp.493-494, 2004

To analyze the impact on the environment due to any industrial activity and our daily living, the energy supply and demand are clearly an essential point within energy development. This study provides an LCA (Life Cycle Assessment) scheme of distributed power supplies for electricity and heat demands, which uses various kinds of fuels including natural resources and co-generation systems. The numerical evaluation method, which is proposed by the authors, is used for a numerical standardization measure to evaluate their environmental impacts, especially respecting fossil fuels depletion, rain acidification, global warming and the overall. The cost estimation is also applied to co-generation systems. The results of this study could be useful as recommendation for the further development of sustainable eco-energy supply systems.

Life Cycle Analysis for Electricity Grid Systems in Japan, Anugerah Widiyanto, Naoki Maruyama and Seizo Kato: Proceedings of 41st National Heat Transfer Symposium of Japan, Vol. II, pp.495-496, 2004

Recent years have seen an upsurge of interest in life cycle assessment (LCA) as a tool for evaluation of potential environmental impacts of any industrial activity. It is often found that the main environmental impacts generated from electricity consumed e.g. during manufacturing and usage stage of industrial products. In Japan, 10 electric companies supply electricity to the entire regions. Therefore, in this study, the life cycle inventories for the 10 electricity companies in Japan were developed based on fiscal year 2002 data. The life cycle emissions were estimated for the systems using a combination of process analysis and input-output analysis. For the life cycle impact assessment (LCIA) method, the proposed LCA consolidated evaluation technique called LCA-NETS (Numerical Eco-load Total Standard) method is used. As the result, the LCA evaluations are discussed for further ecological improvement.

High Yield CO_2 Conversion into CH_4 by Photocatalyst Coated on Cu Substrate, Seizo Kato, Akira Nishimura, Nobumasa Sugiura, Naoki Maruyama and Shinji Kato*: Proceedings of 41st National Heat Transfer Symposium of Japan, Vol. II, pp.501-502, 2004

Mass conversion of CO_2 into CH_4 by photocatalyst is attractive technique to form carbon circulation system. Although feasibility studies of photocatalytic conversion of CO_2 into fuel-like species of CH_4 etc. was performed, their converted yields remained within 100 ppm. Such a low yield makes it difficult to confirm the mass balance experimentally during the photocatalytic conversion process. In this paper, the innovative photocatalytic film having a high yield over 2000 ppm for the CO_2 conversion into CH_4 is realized with the aid of a multi layer TiO_2 film coated on Cu substrate by a modified sol-gel technique.

Producing Fuel from CO_2 by Photocatalyst –Investigation on a Way of Improving Reforming Concentration-, Akira Nishimura, Nobumasa Sugiura, Mitsumasa Fujita, Seizo Kato and Shinji Kato*: Proceedings of SCEJ 70th Annual Meeting, CD-ROM, 2004

Nowadays, because of mass consumption of fossil fuel, global environmental problems such as fossil depletion and increase of CO_2 emission which is a main reason of global warming become serious. According to previous studies, it is informed that CO_2 is reformed into fuel-like species like CO, CH_4, etc. by photocatalyst. If this CO_2 reforming technology realizes as a practical system, a carbon circulation cycle is constructed, resulting that it becomes possible to decrease the amount of fossil fuel usage and CO_2 emission. However, the order of reported concentration of reforming products was from 10 to 100 ppmV which was still low to utilize as a fuel. Additionally, the investigation on improvement of CO_2 reforming was not carried out well. In this study, the photocatalyst which is coated on a copper tube by sol-gel and dip coating method is used, and the influence of photocatalyst coating conditions on CO_2 reforming has been investigated.

Dynamics of large-scale structures of natural convection in a vertical channel, Koichi TSUJIMOTO, Naohiro OHYA and Toshihiko SHAKOUCHI: Nagare 23 pp.461-469, 2004

Direct numerical simulations of natural convection in differentially heated vertical channel are conducted with Boussinesq approximation. The discritization of computation is carried out with a spectral method for three directions. Rayleigh number (Ra) which is defined with the channel width and the temperature difference between both walls, is 5.4×10^4. We extract the large-scale structures by using Snapshot POD (Proper Orthogonal Decomposition) and trace the time evolution of the structures. The formation and the breakdown of the large-scale streaky structures are observed sequentially in one cycle, suggesting that the regeneration process of the large scale flow is similar to the case of a minimal plane Couette flow. Also it is found that the strong down-wash event, due to the large scale vertical flow, play a key role for the heat transfer on the wall.

Drag Reduction of Abrupt Contraction Pipe (Control of Flow Separation by Small Obstacle), Toshitake ANDO, Toshihiko SHSKOUCHI and Keigo MIYATA: Transaction of the Japan Society of Mechanical Engineers, 70-691 B, pp.650-656, 2004.

A New Surface Fusing, Globular Forming Method of Fine Particle, Hirokazu NAKAMURA and Toshihiko SHAKOUCHI: Trans. of the JSME, 70-699 B, pp.2935-2942, 2004

Studies on Air Entrainment and Aeration by Plunging water Jet Flow, Toshihiko SHAKOUCHI, Munehiro OHIKE, Satoshi NISHIYAMA, Koichi TSUJIMOTO and Toshitake ANDO: Prof. of 15th Int. Symp. on Transport Phenomena, CD-ROM, 2004.

The Effects of Impinging Velocity and Angle of Submerged Water Jet Flow on Melting of Ice, Toshihiko SHAKOUCHI, Yuko ISHI, Kentaro MATSUBARA, Koichi TSUJIMOTO and Toshitake ANDO: Prof. of 15th Int. Symp. on Transport Phenomena, CD-ROM, 2004.

PIV Measurements of Flow Characteristics Around Two-Tandem Square Cylinder in Gas-Liquid Bubbly Flow, Toshihiko SHAKOUCHI, Takumi NAKAMURA, Junichiro KAWAGUCHI, Alexandros Voutsinas, Koichi TSUJIMOTO and Toshitake ANDO: Proc. of 4th Int. Symp. on Measurement Techniques of Multiphase Flows, CD-ROM, 2004.

Flow Characteristics Around and Drag of Obstacle in Vertical Upward Gas-Liquid Bubbly Pipe Flow, Toshihiko SHAKOUCHI, Takumi NAKAMURA, Alexandros Voutsinas, Junichiro KAWAGUCHI and Koichi TSUJIMOTO: Proc. of 3rd Int. Symp. on Two-Phase Flow Modeling and Experimentation, CD-ROM, 2004.

New Jet Mill and Pneumatic Classifier, Toshihiko SHAKOUCHI and Hiroshi MORIMOTO: Journal of Japanese Society of Experimental Mechanics, 4-3, pp.12-19, 2004.

Flow and heat Control of High Temperature Air Jet and Application to Surface Fusing of Fine Particle, Hirokazu NAKAMURA and Toshihiko SHAKOUCHI: Proc. of Int. Conf. on Multiphase Flow, CD-ROM, 2004.

A Study on Supersonic Pulverization of Fine Particle, Hiroshi MORIMOTO, Toshihiko SHAKOUCHI, Takuya FUJII and Yukiya ICHIMINAMI: Kagaku Kogaku Ronbunshu, 30-6, pp.802-807, 2004

Department of Electrical and Electronic Engineering

*nonmember

A Study about the Posture and Joint Stiffness at Stationary Force Control of Human Arm, Syugo UCHIDA, Satoshi KOMADA, and Junji HIRAI: Proceedings of the 8th International Workshop on Advanced Motion Control, pp.359-362, 2004.

The purpose of our research is to realize a simple and high performance control of robots using strategy of human arm operation. This time, we measure joint angle and joint stiffness of human arm during force control. When tip force is large, human being selects the posture using joint torque minimum index. When tip force is small, human being selects the posture so that manipulability becomes large. Moreover, the wrist stiffness becomes large so as to keep the posture. In order to adapt for perturbation, a regulator to avoid joint torque saturation is introduced. The effectiveness of this strategy is confirmed by a simulation result of human arm.

Joint Design Method Based on Coprime Factorization of 2DOF Control System, Tsuyoshi HIOKI, Kazuhiro YUBAI, and Junji HIRAI: Proceedings of the 8th International Workshop on Advanced Motion Control, pp.523-527, 2004.

In many cases, control system synthesis is formulated as minimization of prescribed closed loop performance reflecting control requirements. Since the closed loop performance is a function of a controlled plant and a controller, a model identification and a controller design must interact with each other. This motivates us to consider the model identification and the controller design simultaneously. However, most of the previous joint design methods are not applicable to unstable plants because the identified plant model is usually used as the design parameter. On the other hand, we have analyzed the internal structure of 2DOF control system using a coprime factorization on RH_∞ and shown that two free parameters, K and Q RH_∞, specify the tracking performance and the feedback performance, respectively. Also Tay et.al have proposed a parameterization of the plant dynamics by switching the role of the controlled plant and the controller, and introduced a free parameter R belonging to RH_∞. In this paper, we propose a new joint design strategy based on the identification of R and the design of Q. Since the identified plant parameter R is always stable, the proposed joint design strategy can be applied to a wider class than the conventional joint design method.

Fault-Tolerant Control System of Flexible Arm for Sensor Fault by Using Reaction Force Observer, Yu IZUMIKAWA, Kazuhiro YUBAI, Junji HIRAI: Proceedings of the 8th International Workshop on Advanced Motion Control, pp.583-588, 2004.

In recent years, control system reliability has received much attention with increase of situations where computer-controlled systems such as robot control systems are used. In order to improve reliability, control systems need to have abilities to detect a fault (fault detection) and to maintain stability and control performance (fault tolerance). In this paper, we address the vibration suppression control of a one-link flexible arm robot. Vibration suppression is realized by an additional feedback of a strain gauge sensor attached to the arm besides motor position. However, a sensor fault (e.g., disconnection) may degrade the control performance and make the control system unstable at its worst. In this paper, we propose a fault tolerant control system for strain gauge sensor fault. The proposed control system has a strain gauge sensor signal observer based on the reaction force observer and detects the fault by monitoring the estimation error. After fault detection, the proposed control system exchanges the faulty sensor signal for the estimated one and switches to a fault mode controller so as to maintain the stability and the control performance. We

apply the proposed control system to the vibration suppression control system of a one-link flexible arm robot and confirm the effectiveness of the proposed control system by some experiments.

Tracking of Moving Object by Manipulator Using Estimated Image Feature and Its Error Correction on Image Planes, Dai NISHIO, Masaru NAKAMURA, Satoshi KOMADA, and Junji HIRAI: Proceedings of the 8th International Workshop on Advanced Motion Control, pp.653-657, 2004.

This paper proposes a new visual servo system compensating delay time of image processing. To obtain an image feature without delay time, variation of image feature of manipulators during delay time is estimated by a Jacobian matrix from joint velocity to image feature. An image feature of moving object during delay time is estimated from a simple model by using the average velocity/acceleration that are calculated from the past image data. Moreover, its estimation error is reduced by a method based on past estimation error. The effectiveness of the proposed strategy is confirmed by a tracking of a moving object by a manipulator.

A Preliminary Study for Reconfigurable Robot System, Akihiko MATSUURA, Yuji ISHIKURA, and Junji HIRAI: Proceedings of the 30th Annual Conference of the IEEE Industrial Electronics Society (IECON 2004), vol. 2, pp.1052-1057, 2004.

In order to expand the scope of robot application, the robot should cope with the divergence of the assigned tasks and surrounding environments. With the conventional type of robot, however, the scope of the application is limited due to the lack of its reconfigurability. The authors, therefore, propose to realize a novel robot called reconfigurable robot, which is capable of changing its structure adaptively to the situation and the given tasks. The fundamental features of the robot are introduced and problems to be solved for its realization are described in this paper.

Preliminary Study on Robotic Exercise Therapy, Takashi HISADA, Noboru OKUYAMA, Satoshi KOMADA, and Junji HIRAI: Proceedings of the 30th Annual Conference of the IEEE Industrial Electronics Society (IECON 2004), vol. 3, pp.2780-2785, 2004.

This paper proposes a new concept of robotic exercise that displays human muscle force during rehabilitation procedures. The estimation is made by combination of an isokinetic dynamometer improved from its original usage for rehabilitation and a conventional muscle force estimation method based on a musculo-skeletal model which has been applied for human gait analysis. The novel isokinetic dynamometer the authors developed has a force sensor for the musculo-skeletal model analysis, and provides an arbitrary training trajectory control function. The musculo-skeletal model analysis is constructed limitedly to the under limb movement, and the muscle force estimation is made in the thigh area by employing the two optimization methods. As a result of experiments, we confirmed that there is really not much difference between the results of two methods.

Harmonic Current Suppression Using Repetitive Control for Improvement of PMSM Control Performance, Jeong-seong KIM, Shinji DOKI, Muneaki ISHIDA : IEEJ Trans. IA, Vol. 124, No. 12, pp. 1189-1196, 2004

Flashing Phenomena in Square Wave Alternating Current –Flash Welding Control by Use of PWM Inverter Power

Supply (1st Report)-, Yukihiko SATO, Muneaki ISHIDA : Quar. J. JWS, Vol. 22, No. 3, pp. 417-423, 2004

Continuous Flashing Control Using PWM Inverter –Flash Welding Control by Use of PWM Inverter Power Supply (2nd Report)-, Yukihiko SATO, Muneaki ISHIDA : Quar. J. JWS, Vol. 22, No. 3, pp. 424-429, 2004

Resistance Heating Control with A Few Flashing Using PWM Inverter –Flash Welding Control by Use of PWM Inverter Power Supply (3rd Report)-, Yukihiko SATO, Muneaki ISHIDA : Quar. J. JWS, Vol. 22, No. 3, pp. 430-434, 2004

Basic Study on Conductive Characteristics of SiC Power Device for Its Application to AC/DC Converter, Tatsuya MATSUKAWA, Hirotaka CHIKARAISHI*, Yoshihisa SATO*, Ryuichi SHIMADA* : IEEE Trans. on Applied Superconductivity, Vol. 14, No. 2, pp. 690-692, 2004

Modeling of a Small Wind Power Generating System and Design of its Control System, Takashi NONOYAMA, *Shengtie WANG, Naoki YAMAMURA and Muneaki ISHIDA: Proceedings of international conference on Electrical Engineering 2004 (ICEE 2004), p.p.525-530, 2004

Construction of Solar Module Simulator Using Linear Amplifier, Hiroto HAYASHI, Naoki YAMAMURA and Muneaki ISHIDA: Proceedings of international conference on Electrical Engineering 2004 (ICEE 2004), p.p.542-547, 2004-7

A Study of Combined-type Active Filter using Linear Power Amplifier [In Japanese], Rieko MORIYA, Naoki YAMAMURA, Muneaki ISHIDA and Takamasa HORI: IEEJ Trans. IA, Vol.124, No.5, p.p.442-449, 2004

Direct visualization of electromagnetic micro-field by superposition of three types of electron holograms, Masaaki OKUHARA*, Akinori OHSHITA, Yohei YAMAKAWA, Koichi HATA and Kazuo IIDA : Proceedings of 8th Asia-pacific Conference on Electron Microscopy, 2004

A new electron holographic method is presented for direct visualization of electromagnetic micro-fields. In this method, three types of electron holograms obtained under the same operating condition of an electron biprism are superposed. The phase information which cannot be extracted from the modified double-exposure electron hologram can be obtained. This implies that we can get the more information by using three types of electron holograms.

Direct visualization of magnetic micro-field around a barium ferrite particle by modified double-exposure electron holography, Akinori OHSHITA, Masaaki OKUHARA*, Yohei YAMAKAWA, Koichi HATA and Kazuo IIDA : Proceedings of 13th European Microscopy Congress, 2004

Double-exposure electron holography, three-electron-wave interference method and four-electron-wave interference method were developed for direct visualization of pure phase objects such as electromagnetic micro-fields. Although the three-electron-wave and four-electron-wave interference methods are very useful, two electron biprisms are indispensable. Therefore we proposed the modified double-exposure electron holographic method using an electron biprism. In this paper, we present an experimental result of magnetic-field observation with this method.

Low molecular weight of fluid in an alloy of EPDM/SIR, Kazuo IIDA and Reuben HACKAM*, 2004 Annual Report Conference on Electrical Insulation and Dielectric Phenomena, pp.607-610, 2004

Ethylene propylene diene rubber (EPDM), silicone rubber (SIR) and their alloys have good performance when used as outdoor insulators. The hydrophobicity of the surface is maintained in wet and polluted conditions as a result of the presence of silicone fluid on the surface. This is sustained by the diffusion of low molecular weight (LMW) fluid from the bulk to the surface. The amount of LMW fluid on the surface and in the bulk of the material determines the hydrophobicity during the lifetime of the alloy of EPDM/SIR used as insulators. A study of the amount, loss and generation of the LMW fluid in an alloy of EPDM/SIR used for outdoor insulators has been performed as a function of temperature in order to simulate the effects of the heat generated by the dry band arcings on the surface. From an infrared (IR) spectroscopy study, the LMW fluid extracted from the virgin specimen is found to be composed of two kinds of fluids; one comes from the EPDM and the other comes from the SIR components of the alloy. The component of the fluid from the SIR initially decreases with sequential heating at 200 ^{o}C for 32 h in air and extraction by immersion in hexane at 44 ^{o}C for 96 h, but then the component of the fluid from EPDM finally becomes predominant.

Two Dimensional Motion Tracking of Left Ventricular Myocardium Using Ultrasonic Doppler Signal, Wataru OHYAMA, Toshikazu MURAMATSU, Tetsushi WAKABAYASHI, Fumitaka KIMURA, Shinji TSURUOKA, and Kiyotsugu SEKIOKA*: Proc. of the Sixth IASTED International Conference on Signal and Image Processing, pp.436-440 (#444-187), 2004

Automatic Tracking for Regional Myocardial Motion by Correlation Method with Connecting Multiple ROIs, Wataru OHYAMA, Masaki INAMI, Tetsushi WAKABAYASHI, Fumitaka KIMURA, Shinji TSURUOKA, and Kiyotsugu SEKIOKA*: IEEJ Transactions on Electronics, Information and Systems

Regional Tissue Estimation for Myocardium Using Phase Frequency Spectrum of Ultrasonic RF Signal, Yoshikadu YASUMOTO, Hirotake ISHII, Shinji TSURUOKA, Fumitaka KIMURA, Tetsushi WAKABAYASHI, Wataru OHYAMA, and Kiyotsugu SEKIOKA*: The tenth International Conference on Virtual Systems and Multimedia (VSMM2004) , pp.82-88, 2004

Hybrid Automatic Tracking of Regional Myocardium from Ultrasonic RF Echo Signal Using Cardiac Cycle Estimation, Akihiko KAWABATA, Shinji TSURUOKA, Wataru OHYAMA, Hiroharu KAWANAKA* and Kiyotsugu SEKIOKA*, The tenth International Conference on Virtual Systems and Multimedia (VSMM2004) , pp.307-310, 2004

Nurse Scheduling Support System Using Genetic Algorithm and its Development, Hiroharu KAWANAKA*, Tomohiro YOSHIKAWA, Shinji TSURUOKA, Tsuyoshi SHINOGI and Koji YAMAMOTO*, The tenth International Conference on Virtual Systems and Multimedia (VSMM2004), pp.526-535, 2004

An Individual Guidance System on Keywords Written by a Lecturer for e-Learning Using a Pen Capture Tool, Kazuyuki NISHIKIMI, Yuuki YADA, Shinji TSURUOKA, Tomohiro YOSHIKAWA and Tsuyoshi SHINOGI, The tenth International Conference on Virtual Systems and Multimedia (VSMM2004) , pp.1015-1022, 2004

The determination method of camera View Using Active Cameras and Whiteboard Capture Tool for Image Based e-Learning, Keiichi SHIRASAWA, Yuuki YADA, Shinji TSURUOKA, Tomohiro YOSHIKAWA and Tsuyoshi SHINOGI, The tenth International Conference on Virtual Systems and Multimedia (VSMM2004) , pp.1023-1032, 2004

Between-core Vector Overlapping for Efficient Core Testing of System-On-Chip LSI Circuits, Tsuyoshi SHINOGI, Yuki YAMADA, Terumine HAYASHI, Tomohiro YOSHIKAWA, Shinji TSURUOKA, The IEICE Transactions on Information and Systems, Vol.J87-D-I, No.6, pp.702-711, 2004

Test Vector Overlapping for Test Cost Reduction in Parallel Testing of Cores with Multiple Scan Chains, Tsuyoshi SHINOGI, Yuki YAMADA, Terumine HAYASHI, Tomohiro YOSHIKAWA, Shinji TSURUOKA, 5th Workshop on RTL and High Level Testing(WRTLT'04), pp.117-122, 2004

A Study for Wireless TCP Access with Base Station Diversity, Katsuhiro NAITO, Hiroshi. OKADA*, Takaya. YAMAZATO*, and Masaaki. KATAYAMA*: IEICE Transactions on Communications, vol. J87-B, no.4, pp.512-523, April 2004. [in Japanese]

Frequency Band and Time Slot Selection Scheme for Downlink Packet Communications in Cellular Band Division MC-CDM Systems, Kazuo MORI and Hideo KOBAYASHI: IEICE Transactions on Communications, Vol.E87-B No.5, pp.1114-1122, May 2004.

Clipping and Inter-modulation Noise Mitigation Method for OFDM Systems, Pisit BOONSRIMUANG, Pornphavit BOONSRIMUANG*, Kazuo MORI, Hideo KOBAYASHI and Tawil PAUNGMA*: Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology Conference (ECTI-CON 2004), May 2004.

Dynamic Cell Configuration Scheme for Common Channel Communications in CDMA Cellular Packet Systems, Kazuo MORI and Hideo KOBAYASHI: IEEE International Conference on Communications (ICC2004), Paris, June

2004.

An Advanced CSMA Inter-Vehicle Communication System using Packet Transmission Timing Decided by the Vehicle Position, Tomotaka NAGAOSA*, Yukinari KOBAYASHI, Kazuo MORI and Hideo KOBAYASHI: IEEE Intelligent Vehicle Symposium (IV04), June 2004.

Proposal of SDM-SCOFDM System with Adaptive Modulation Method over MIMO Channels, Yuanrun TENG, Kazuo MORI and Hideo KOBAYASHI: IEICE Transactions on Communications, Vol. E87-B, No.9, pp.2757-2766, Sep.2004.

Radio Resource Assignment Scheme for Asymmetric Traffic in CSMA/Shared-TDD Cellular Packet Communications, Yukinari KOBAYASHI, Kazuo MORI and Hideo KOBAYASHI: IEEE Vehicular Technology Conference (VTC 2004-Fall), Sep. 2004.

Downlink Packet Transmission Control for Asymmetric Traffic in CDMA/Shared-TDD Cellular Communication Systems, Kazuo MORI and Hideo KOBAYASHI: IEEE International Symposium on Spread Spectrum Techniques and Applications (ISSSTA04), Sep. 2004.

Proposal of OFDM Channel Estimation Method using Discrete Cosine Transform, Hideo KOBAYASHI and Kazuo MORI: IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC2004), Sep. 2004.

Performance of DCT Interpolation-based Channel Estimation Method for MIMO-OFDM Systems, Yuanrun TENG, Kazuo MORI and Hideo KOBAYASHI: International Symposium on Communications and Information Technologies 2004 (ISCIT 2004), Oct. 2004.

Soft Handoff Technique for Downlink IP Packet Transmissions in Cellular Environments, Abubaker KHUMSI, Kazuo MORI and Hideo KOBAYASHI: International Symposium on Communications and Information Technologies 2004 (ISCIT 2004), Oct. 2004.

QAM-OFDM System with IDAR Method in Satellite Channel, Pist BOONSRIMUANG, Kazuo MORI, Tawil PAUNGMA and Hideo KOBAYASHI: IEICE Joint Conference on Satellite Communications 2004 (JCSAT2004), Oct. 2004.

A Study on the Simple Penalty Term to the Error Function from the Viewpoint of Fault Tolerant Training, Haruhiko TAKASE, Hidehiko KITA and Terumine HAYASHI: Proc. of 2004 International Joint Conference on Neural

Networks (IJCNN2004), pp.1045-1050, 2004

On Generating Test Data with High Compressibility, Naohhiro HIRAIWA, Terumine HAYASHI, Tsuyoshi SHINOGI, Haruhiko TAKASE, and Hidehiko KITA: Proc. of IEEE 5th Workshop on RTL and High Level Testing (WRTLT'04), pp.59-64, 2004

A CAI System for Increasing Learners' Confidence in Answers, Shinobu TABATA, Hidehiko KITA, Haruhiko TAKASE, Terumine HAYASHI and Tsutomu SHIMOMURA: Proc. of International Conference on Computers in Education 2004 (ICCE2004), CD-ROM, 2004

A System for Determining Students' Comprehension during Lectures, Naoki MORITA*, Hidehiko KITA and Kanji AKAHORI*: International Conference on Computers in Education 2004 (ICCE2004), CD-ROM, Nov. 2004

A Practical Method of Multiple-Choice Questions in Formative Tests [In Japanese], Shinobu Tabata, Naoki MORITA*, Hidehiko KITA, Haruhiko TAKASE, Terumine HAYASHI and Tsutomu SHIMOMURA: Council for Improvement of Education through Computers, Computer & education, Vol.17, pp.126-132, 2004

Influence of etching condition on surface morphology of AlN and GaN layers, Noriyuki KUWANO*, R. TAJIMA*, Shinya BOHYAMA, Hideto MIYAKE, Kazumasa HIRAMATSU and Tomohiko SHIBATA*: Phys. Stat. Sol. (a) 201, pp. 2755-2759, 2004

Time-resolved nonlinear luminescence of excitonic transistors in GaN, Yoichi YAMADA*, Yohei YOSHIDA*, Tsunemasa TAGUCHI*, Hideto MIYAKE, Kazumasa HIRAMATSU, Yasushi IYECHIKA and Takayoshi MAEDA*: J. Appl. Phys. 96, pp. 138-143 2004

Characterization of III-nitride based Schottky UV detectors with wide detectable wavelength range (360-10 nm) using Synchrotron Radiation, Atsushi MOTOGAITO, Kazumasa HIRAMATSU, Yasuhiro SHIBATA, Hironobu WATANABE, Hideto MIYAKE, Kazutoshi FUKUI*, Youichiro OHUCHI*, Kazuyuki TADATOMO* and Yutaka HAMAMURA: Mat. Res. Soc. Symp. Proc. 798, pp. 53-58 2004

Low-dislocation density GaN and AlGaN using epitaxial-lateral-overgrowth methods, Kazumasa HIRAMATSU and Hideto MIYAKE: Electrochemical Society Proceedings 2004-06, pp.472-483, 2004

Characterization of freestanding metal optical filters and GaN UV detectors in VUV and SX region, Atsushi MOTOGAITO, Hironobu WATANABE, Kazumasa HIRAMATSU*, Kazutoshi FUKUI*, Yutaka HAMAMURA* and Kazuyuki TADATOMO*: UVSOR ACTIVITY REPORT 2003, p.60, 2004

Characterization of UV detectors with n-AlGaN on AlN epitaxial films, Kazumasa HIRAMATSU, Yasuhiro SHIBATA, Hiroyuki YASUKAWA, Atsushi MOTOGAITO, Hideto MIYAKE, Youichro OHUCHI*, Kazuyuki TADATOMO*, Tatsushi NOMURA*, Yutaka HAMAMURA* and Kazutoshi FUKUI*: UVSOR ACTIVITYREPORT 2003, p. 70, 2004

Electrical and Magnetic Properties of La(Ba)MnO3 Thin Films, Tamio ENDO, Shin-ichi IWASAKI, Kouji YOSHII, Takahisa SAKURADA, Michi OGATA, Ajay SARKAR, Josep NOGUES*, Juan MUNOZ*, Jose COLINO*: Trans. Mat. Res. Soc. Jpn. 29(4), pp.1431-1436, 2004

Fabrication of YBCO and LBMO Thin Films, and Double Layered Nanocomposite, Tamio ENDO, Masanori OKADA, Michi OGATA, Takahisa SAKURADA, Ajay SARKAR: Proc. ICCE-11 (South Carilina, 2004), pp.157-158, 2004

Synthesis by MOCVD of c-axis Bi2Sr2Ca2Cu3O10 Superconducting Thin Films on (001) and (110) MgO Substrates, Kazuhiro ENDO*, Peter BADICA*, Tamio ENDO: Proc. APMC (New Delhi, 2004), pp.790-793, 2004

Microwave Absorption Depending on Field Sweep Rate and Anisotropic Vortex Dynamics in a-Oriented Superconducting YBCO Thin Film, Tamio ENDO, Akinori HASHIZUME, Masanori OKADA, Takahisa SAKURADA, Ajay SARKAR, Masashi MUKAIDA*: Proc. APMC (New Delhi, 2004), pp.698-701, 2004

Brightness of electron beam emitted from a single pentagon on a multiwall carbon nanotube tip, Koichi HATA, Akihiro TAKAKURA, Akinori OHSHITA, and Yahachi SAITO*: Surface and Interface Ana2004lysis 36, pp.506-509, 2004

A capped multiwall carbon nanotube (MWNT) with clean surface gives field emission patterns consisting of six pentagonal rings corresponding to pentagons located at the tip. To evaluate optical properties of a single pentagon as an electron source, I-V characteristics and angular current densities for a single clean pentagon have been measured by probe-hole type field emission microscopy (FEM). A reduced brightness estimated from the angular current density and the geometrical size of pentagon, reached about 5.6×10^9 A/(m^2srV) at an emission current of 53 nA. This value of reduced brightness is one order of magnitude or more higher than that of individual MWNT field emitter reported by Jonge *et al*.

Interference fringes observed in electron emission patterns of a multiwall carbon nanotube, Koichi HATA, Akihiro TAKAKURA, Kenji MIURA, Akinori OHSHITA, and Yahachi SAITO*: Journal of Vacuum Science & Technology B, 22, 3, pp.1312-1314, June ,2004

A capped multiwall carbon nanotube (MWNT) with clean surface gives field emission patterns consisting of six pentagonal rings which correspond to pentagons located at the tip end. One or a few bright streaks are also observed at the boundaries of neighboring pentagons. The spacing of streaks is inversely proportional to the square root of the accelerating voltage. Namely, the spacing changes with the wave length of emitted

electrons according to Young's interference equation. The visibility of streaks increased with the accelerating voltage, which can be explained successfully in terms of a concept of a virtual source size. These experimental results suggest that the streaks are no more than Young's interference fringes for which the adjacent pentagons behave as double slits.

Fabrication of carbon nanotube array and its field emission property, H. SATO, H. TAKEGAWA, H. YAMAJI, H. MIYAKE, K. HIRAMATSU and Y. SAITO*: Journal of Vacuum Science & Technology B 22 (3) pp.1335-1337, 2004

A novel fabrication process for carbon nanotubes (CNTs) field emitter array is reported. This process consists of formation of a protrusion on a silicon substrate, selective deposition of catalyst film on tips of the protrusions and direct growth of carbon nanotubes on the tips of the protrusions by plasma-enhanced chemical vapor deposition (PECVD). In this process, number of the CNTs grown on each tip of the protrusion can be controlled by size of the protrusion. The CNTs field emitter arrays gave better field emission property than a continuous CNTs film. A threshold voltage required to obtain $1\mu A/cm^2$ of field emission current from the CNTs field emitter array was about 300V lower than that from the continuous CNTs film. This improvement is presumably due to reduction of screening effect, which prevents the field from concentrating on the tip of the CNT emitters.

Composite Materials and Their Applications, Shuhei NAKAMURA, Yusuke AOKI, Takuya SHINDOU*, Tetsushi OKAMOTO*: Proceedings of the XXVIII International Conference of International Microelectronics & Packaging Society -Poland Chapter-(2004-9), pp. 69-76, 2004

Electrical Properties of Composite Materials and their Functionalization, Tetsushi OAKAMOTO*, Takuya SHINDOU*, Shuhei NAKAMURA: Proceedings of the 11th Annual International Conference on Composites/Nano Engineering, pp. 527-530, 2004

Functionalization of Organic-Inorganic Hybrid Materials [in Japanese]. Takuya SHINDOH*, Makoto SUGIURA, Yusuke AOKI, Shuhei NAKAMURA, Kanichi KAMIYA: Proceedings of the 35th symposium on electrical and electronic insulating materials and application in systems, pp. 97-100, 2004

Super Low-resistive Composites Made with Thermoplastic Elastomer, Graphite and Carbon Black [in Japanese], Hirotomo MINAMIYAMA, Mitsuhiro HISHIDA, Kouichi TACHI, Yusuke AOKI, Shuhei NAKAMURA: Proceedings of the 35th symposium on electrical and electronic insulating materials and application in systems, pp. 205-208, 2004

Department of Chemistry for Materials

* nonmember

Effect of "Topotactic" Reduction Product of Tungsten Disulfide on Catalytic Activity of Metallocene Catalyst for Olefin Polymerization, Satoru YAMADA, Akihiro YANO*, Morihiko SATO*, Takahito ITOH : Journal of Molecular Catalysis A: Chemical 208, pp. 55-65, 2004

N,N-Dimethylanilinium ($Ph(Me)_2NH^+$) salt of tungsten disulfide (WS_2) was developed as a novel cocatalyst for metallocene catalysts. The cocatalyst is composed of *N,N*-dimethylanilinium ion as a cationic part and "topotactic" reduction product of WS_2, obtained by acquisition of an electron by the neutral host lattice of WS_2 without structural alteration, as an anionic part. Notable improvement of the catalytic activity for ethylene polymerization using the bis(indenyl)zirconium dichloride (Ind_2ZrCl_2)/triethylaluminum (Et_3Al) catalyst was observed upon the addition of the $Ph(Me)_2NH^+$ salt of WS_2. The addition of the corresponding molybdenum disulfide (MoS_2) one that had smaller crystallite size than the $Ph(Me)_2NH^+$ salt of WS_2 showed the lower catalytic activity. The resultant poly(ethylene) prepared by the $Ind_2ZrCl_2/Et_3Al/Ph(Me)_2NH^+$ salt of WS_2 possessed similar properties like narrow polydispersity to that prepared by conventional metallocene type catalysts. The Zr loadings on the precipitate of the Ind_2ZrCl_2/Et_3Al catalyst activated by the $Ph(Me)_2NH^+$ salt of WS_2 increased with a decrease in the crystallite size of the $Ph(Me)_2NH^+$ salt of WS_2. However, the catalytic activities in ethylene polymerization decreased drastically, indicating that the decrease of the crystallite size led to the significant increase of inactive species for ethylene polymerization.

Spontaneous Polymerization Mechanism of 7,7-Dicyanobenzoquinone Methide with p-Methoxystyrene, Yukihiro MITSUDA, Shuji KAWAGUCHI, Takahiro UNO, Masataka KUBO, Takahito ITOH : Macromolecules 37, pp. 1251-1256, 2004

Spontaneous polymerization of 7,7-dicyanobenzoquinone methide (CQM) with p-methoxystyrene (MeOSt) was investigated. An alternating copolymer of CQM with MeOSt was obtained as the hexane-insoluble product, and a small amount of a 1:2 cycloadduct of CQM:MeOSt in addition to large amounts of unreacted CQM and MeOSt was obtained as the hexane-soluble product. To clarify an active intermediate in this reaction, spontaneous polymerizations of CQM with MeOSt were carried out in the presence of additives such as 2,2,6,6-tetramethylpiperidine-1-oxy (TEMPO) and acetic acid and in three solvents with different polarity. The spontaneous reaction in the presence of the TEMPO did not afford any products trapped by TEMPO. On the other hand, the reaction in the presence of acetic acid gave a 1:1:1 adduct of CQM:MeOSt:acetic acid in a quantitative yield. It was concluded from these results that the spontaneous polymerization of CQM with MeOSt might proceed via a zwitterionic intermediate, which has gauche and trans forms.

Crystal Structures and Topochemical Polymerizations of 7,7,8,8-Tetrakis(alkoxycarbonyl)quinodimethanes, Shinji NOMURA, Takahito ITOH, Hirofumi NAKASHO, Takahiro UNO, Masataka KUBO, Kazuki SODA*, Katsunari INOUE*, Mikiji MIYATA* : Journal of American Chemical Society 126, pp. 2035-2041, 2004

Highly conjugated monomers, 7,7,8,8-tetrakis(alkoxycarbonyl)quinodimethanes (methoxy (1a), ethoxy (1b), isopropoxy (1c), benzyloxy (1d), chloroethoxy (1e), and bromoethoxy (1f)), were synthesized. Recrystallizations of 1a, 1c, 1e, and 1f yielded two crystal forms (prisms (1a-A) and needles (1a-B), needles (1c-A) and plates (1c-B), prisms (1e-A) and plates (1e-B), and prisms (1f-A) and needles (1f-B)), which have different molecular packing modes by X-ray crystal structure analysis, indicating that the crystals are polymorphic. In the photopolymerizations of these monomer crystals in the solid state, 1a-A, 1e-A, and 1f-A polymerized topochemically to give crystalline polymers. For their thermal polymerizations in the solid state, in addition to 1a-A, 1e-A, and 1f-A, 1e-B and 1f-B polymerized, but polymers formed from the 1e-B and 1f-B were amorphous. The packing of quinodimethane molecules in the crystals was defined by four kinds of parameters, stacking distance (d_s), the distance between the reacting exomethylene carbon atoms (d_{cc}), the angles formed between the stacking axis and longer axis of the monomer molecule (θ_1), and the shorter axis of the monomer molecule (θ_2), and then the polymerization reactivity of these quinodimethanes in the solid state was discussed on the basis of these parameters.

Ionic Conductivity and Mechanical Property of Cross-linked Hyperbranched Polymer Electrolytes for Lithium Secondary Batteries, Takahito ITOH, Seiji HORII, Shinya HASHIMOTO, Takahiro UNO, Masataka KUBO, Osamu YAMAMOTO* : Transaction of the Materials Research Society of Japan 29, pp. 1025-1030, 2004

Composite polymer electrolytes composed of cross-linkable hyperbranched polymer (HBP), poly[bis(triethylene glycol)benzoate] capped with acetyl and/or acryloyl groups in various ratios, poly(ethylene oxide), $BaTiO_3$ as an inorganic filler, and $LiN(CF_3SO_2)_2$ as a lithium salt were prepared by solvent casting, followed by thermal cross-linking, and their ionic conductivities and mechanical properties were investigated.

Preparation of Mechanically Cross-Linked Polystyrenes, Masataka KUBO, Naoki KATO, Takahiro UNO, Takahito ITOH : Macromolecules 37, pp. 2762-2765, 2004

This paper reports preparation of mechanically cross-linked polystyrenes using cyclic macromonomer as a nonbonding cross-linking agent. Emulsion and thermal self-initiated copolymerizations of styrene with a well-defined cyclic macromonomer based on a cyclic polystyrene were carried out to obtain mechanically cross-linked polystyrenes with high swellability. Mechanically cross-linked chloromethylated polystyrene was prepared by thermal self-initiated terpolymerization of the cyclic macromonomer, styrene, and 4-vinylbenzyl chloride.

Spontaneous Polymerization Mechanism of 7,7-Dicyanobenzoquinone Methide with 1,3-Cyclohexane, Shuji KAWAGUCHI, Yukihiro MITSUDA, Takahiro UNO, Masataka KUBO, Takahito ITOH : Kobunshi Ronbunshu 61, pp. 263-268, 2004

Spontaneous polymerization of 7,7-dicyanobenzoquinone methide (CQM) with 1,3-cyclohexane (CHD) was investigated. The spontaneous reactions gave alternating copolymers of CQM with CHD, where CHD units were incorporated in 1,2- and 1,4-addition structures, as

hexane-insoluble products and a Diels-Alder adduct of CQM with CHD as hexane-soluble product. Addition of acetic acid to the spontaneous polymerization system did not affect the composition and distribution of products. On the other hand, the spontaneous polymerization in the presence of 2,2,6,6-tetramethylpiperidine-1-oxyl (TEMPO) gave a low molecular weight alternating copolymer with TEMPO at the terminal end as hexane-insoluble product and a 1:1:1 adduct as hexane-soluble product. It was concluded from these results that the spontaneous polymerization of COM with CHD proceeds via a diradical intermediate.

Influence of Hyperbranched Polymer Structure on Ionic Conductivity in Composite Polymer Electrolytes of PEO/Hyperbranched Polymer/$BaTiO_3$/Li Salt System, Takahito ITOH, Seiji HORII, Takahiro UNO, Masataka KUBO, Osamu YAMAMOTO* : Electrochimica Acta 50, pp. 271-274, 2004

The influence of the hyperbranched polymer (HBP) structure such as molecular weights, molecular weight distribution, chain-end, ethylene oxide (EO) chain lengths on the ionic conductivity of the composite polymer electrolytes composed of poly(ethylene oxide) (PEO), $BaTiO_3$ as a ceramic filler, $LiN(CF_3SO_2)_2$ as a lithium salt, and HBP as a plasticizer were investigated. The difference in the molecular weights of the HBP did not affect significantly the ionic conductivity. However, molecular weight distribution of the HBP might affect the ionic conductivity of the composite polymer electrolyte, which decreased with broadening of the molecular weight distribution. Further branching at the chain-end structure in the HBP led to a decrease in the ionic conductivity. The HBP with a longer EO chain length was effective to an enhancement of the ionic conductivity.

Spontaneous Polymerization Mechanism of Electron-Accepting Substituted Quinodimethane with Vinyl Ether and Cyclic Ketene Acetal, Yukihiro MITSUDA, Takashige FUJIKAWA, Katsumi NAKASAKA, Takahiro UNO, Masataka KUBO, Takahito ITOH, Journal of Polymer Science: Part A: Polymer Chemistry 42, pp. 3800-3811, 2004

The spontaneous reactions of 1-(2,2-dimethyl-1,3-dioxane-4,6-dione-5-ylidene)-4-(dicyano-methylene)-2,5-cyclohexadiene (QM-1) with a vinyl ether, butyl vinyl ether (BVE), and a cyclic ketene acetal, 2-methylene- 1,3-dioxepane (MDOP), were investigated. The reaction of QM-1 with BVE produced a terpolymer composed of QM-1, 7-butoxy-8,8-dicyanoquinodimethane, and BVE units as a hexane-insoluble product and a one-to-one adduct of methylene Meldrum's acid and BVE as a hexane-soluble product. The spontaneous reaction of QM-1 with BVE produced, in the presence of 2,2,6,6-tetramethylpiperidine-1-oxy (TEMPO), a terpolymer carrying TEMPO units in the chain ends, and in the presence of methanol, a one-to-one-to-one adduct of QM-1, BVE, and methanol was isolated. The spontaneous reaction with bulkier, electron-donating MDOP produced a low-molecular-weight alternating cooligomer of QM-1 with MDOP. The spontaneous polymerization was proposed to proceed via a zwitterionic intermediate taking two forms, gauche and trans, depending on the bulkiness of the comonomer.

Asymmetric Anionic Polymerization of 2,6-Dimethyl-7-phenyl-1,4-benzoquinone Methide, Takahiro UNO, Masaya MINARI, Masataka KUBO, Takahito ITOH : Journal of Polymer Science: Part A: Polymer Chemistry 42, pp. 4548-4555, 2004

Asymmetric anionic polymerizations of 2,6-dimethyl-7-phenyl-1,4-benzoquinone methide (1) were performed with various chiral anionic initiators, and the specific rotations of the obtained polymers were investigated. Optically active poly(1)s with configurational chirality were obtained with all the initiators, and a complex of fluorenyllithium (FlLi) with (-)-sparteine [(-)-Sp] produced poly(1) with the largest negative specific rotation ($[\alpha]_{435}$ = -26.8°). The specific rotations of poly(1)s obtained with FlLi/(-)-Sp depended on the initiator concentration and the solvent polarity. The maximum specific rotations were obtained at an almost constant initiator concentration (ca. 0.03 mol/L), regardless of the monomer concentration, in toluene, whereas a higher initiator concentration was required in more polar solvents. These results suggested that the aggregation state of the propagating chain end significantly affected the specific rotation of poly(1).

Solid-State Polymerization of 7-Alkoxycarbonyl-7-cyano-1,4-benzoquinone Methides, Takahito ITOH, Shinji NOMURA, Nagisa SAITOH, Takahiro UNO, Masataka KUBO, Kazuki SODA*, Katsunari INOUE*, Mikiji MIYATA* : Macromolecules 37, pp. 7938-7944, 2004

Thermal polymerizations and photopolymerizations of 7-alkoxycarbonyl-7-cyano-1,4-benzoquinone methides (methoxy (2a), ethoxy (2b), propoxy (2c), isopropoxy (2d), butoxy (2e), and sec-butoxy (2f)) were investigated in the solid state. In the thermal polymerization in the solid state, 2a, 2c, 2d, and 2e polymerized to give glassy solids or a mass of crystals, but both 2b and 2f did not polymerize. In the photopolymerization in the solid state, all monomer crystals except for 2a polymerized to give corresponding polymers as needlelike solids. The needlelike polymer obtained by photopolymerization of highly reactive 2c was amorphous by powder X-ray diffraction measurement. Crystal structure of 2c was determined by single-crystal X-ray structure analysis, and the molecular packing in the crystals was discussed.

Molecular Oxygen Insertion Polymerization into Crystals of Tetrakis(alkoxycarbonyl)quino-dimethanes, Takahito ITOH, Shinji NOMURA, Masaki OHTAKE, Takafumi YOSHIDA, Takahiro UNO, Masataka KUBO, Atsushi KAJIWARA*, Kazuki SODA*, Mikiji MIYATA* : Macromolecules 37, pp. 8230-8238, 2004

Solid-state alternating copolymerization took place by molecular oxygen insertion in the crystals of 7,7,8,8-tetrakis(ethoxycarbonyl)quinodimethane (1a) and 7,7-bis(ethoxycarbonyl)-8,8-bis(methoxycarbonyl) quinodimethane (1b) to form highly crystalline needlelike white solids for 1a and amorphous ones for 1b. The polymer structures were confirmed by ^{1}H NMR, ^{13}C NMR, IR, elemental analysis, powder XRD, and TGA measurements. However, in vacuo polymerizations of 1a and 1b in the solid state with heating and photoirradiation did not take place. 7,7,8,8-Tetrakis(methoxycarbonyl)quinodimethane (1c) did not undergo solid-state alternating copolymerization with oxygen even in the presence of oxygen, but instead it homopolymerized to form highly crystalline homopolymer. The difference in the solid-state polymerization reactivity was discussed on the basis of molecular packing in the crystals obtained by X-ray crystallography. In addition, it was found by ESR measurement that the solid-state alternating copolymerizations with molecular oxygen proceed by means of a radical mechanism.

Preparation of Mechanically Cross-Linked Poly(vinyl alcohol), Masataka KUBO, Naoki HAYAKAWA, Yuya MINAMI, Masashi TAMURA, Takahiro UNO, Takahito ITOH: Polymer Bulletin 52, pp. 201-207, 2004

A novel cyclic macromonomer based on a cyclic polystyrene was prepared. Its radical copolymerization with vinyl acetate was carried out to give a mechanically cross-linked poly(vinyl acetate) which was converted to a mechanically cross-linked poly(vinyl alcohol) with high swellability.

Polymer Electrolytes Plasticized With Hyperbranched Polymer For Lithium Polymer Batteries, Takahito ITOH, Seiji HORII, Shinya HASHIMOTO, Takahiro UNO, Masataka KUBO: Ionics 10, pp. 450-457, 2004

Hyperbranched polymers (HBPs) with different terminal groups and different ethylene oxide (EO) chain lengths were prepared, and the influence of the HBP structures including molecular weights and molecular weight distribution on the ionic conductivity and the mechanical property of the composite polymer electrolytes composed of poly(ethylene oxide) (PEO), HBP, $BaTiO_3$ as a ceramic filler, and $Li(CF_3SO_2)_2$ as a lithium salt were investigated. It was found that the molecular weights of the HBP do not affect significantly the ionic conductivity, but the molecular weight distribution might affect it, and also further branching at the terminals of the HBP led to decrease in the ionic conductivity. The HBP with longer EO chain length was effective for enhancement of the ionic conductivity in comparison with the HBP with shorter one. The increase in cross-linkable groups (acryloyl group) at the terminals of the HBP improved the tensile strength, but caused the ionic conductivity to decrease. Loosely cross-linked composite polymer electrolyte showed higher ionic conductivity and higher tensile strength than no cross-linked one.

Double Nucleophilic Addition of Azide and Tetraallyltin to the Latent *α,β*-Unsaturated Aldehydes Using in situ Hydrolysis of the Imino Functionality Promoted by Tin(IV) Chloride Pentahydrate, Makoto SHIMIZU, Takafumi NISHI: Synlett, pp. 889-891, 2004

Double Nucleophilic Addition of Azide and Tetramethallyltin to *α,β*-Unsaturated Aldimines Promoted by Aluminum Chloride, Makoto SHIMIZU, Chiaki YAMAUCHI, Toshiki OGAWA: Chem. Lett. 33 (5), pp. 606-607, 2004

Synthesis of 5-Acetyl-2-pyridones via Nucleophilic Addition of *β*-Keto Esters to Alkynyl Imines, Iwao HACHIYA, Kana OGURA, Makoto SHIMIZU: Synthesis, pp. 1349-1352, 2004

Stereodivergent Synthesis of (*2R*)-2,3-Diricinolein by Lipase-catalyzed Hydrolysis of Triricinolein, Iwao HACHIYA, Akihisa MAKINO, Makoto, SHIMIZU, Masatsugu AKITA*, Takashi HAMAGUCHI*: Tetrahedron: Asymmetry 15 (16), pp. 2451-2454, 2004

Aza-Reformatsky-type Reaction of *α*-Iodomethyl Ketone *O*-Alkyl Oximes Promoted by Titanium Tetraiodide, Makoto SHIMIZU, Tadahiro TOYODA: Org. Bio. Chem. 2 (20), pp. 2891-2892, 2004

A Cation-Exchange Resin Promoted Imino Aldol Reaction, Leading to the Synthesis of 2-Isocephem and 2-Oxa-isocephem , Makoto SHIMIZU, Masanori TACHI, Iwao HACHIYA: Chem. Lett. 33 (10), pp. 1394-1395, 2004

An Improved Process for the Large-Scale Preparation of Antirheumatic Agent MX-68, Noriaki MARUYAMA, Hirohito SHIMIZU*, Takashi SUGIYAMA*, Masashi WATANABE*, Masahiro KATO*, Makoto SHIMIZU: Organic Process Research & Development 8 (6), pp. 883-888, 2004

Reductive Coupling of Aldehydes with Nitriles Promoted by Titanium Tetraiodide, Makoto SHIMIZU, Hiroshi GOTO: Lett. Org. Chem. 1 (4), pp. 346-348, 2004

3,4,6-Trisubstituted-2-pyrone Synthesis via the Nucleophilic Addition of 2-Alkyl Meldrum's Acid to Alkynyl Ketone, Iwao HACHIYA, Hitoshi SHIBUYA, Kazuma HANAI, Makoto SHIMIZU: Lett. Org. Chem. 1 (4), pp. 349-352, 2004
Double Nucleophilic Addition of Ketene Silyl Acetals to *α,β*-Unsaturated Imines: Factors Controlling the Regioselectivity, Makoto SHIMIZU, Hiroshi KUROKAWA, Atsushi TAKAHASHI: Lett. Org. Chem. 1 (4), pp. 353-356, 2004.

New Synthetic Reactions Using the Reducing Ability of Titanium Tetraiodide [in Japanese], Makoto SHIMIZU: J. Synth. Org. Chem., Jpn. 62 (3), pp. 205-213, 2004

Elimination-Addition Mechanism for Nucleophilic Substitution Reaction of Cyclohexenyl Iodonium Salts and Regioselectivity of Nucleophilic Addition to the Cyclohexyne Intermediate, Morifumi FUJITA*, Wan Hyeok KIM*, Yuichi SAKANISHI*, Koji FUJIWARA*, Sayaka HIRAYAMA*, Tadashi OKUYAMA*, Yasuhiro OHKI*, Kazuyuki TATSUMI*, Yasunori YOSHIOKA : J. Am. Chem. Soc. 126 (24), pp.7548-7558, 2004

The reaction of 4-substituted cyclohex-1-enyl(phenyl)iodonium tetrafluoroborate with tetrabutylammonium acetate gives both the *ipso* and *cine* acetate-substitution products in aprotic solvents. The isomeric 5-substituted iodonium salt also gives the same mixture of the isomeric acetate products. The reaction is best explained by an elimination-addition mechanism with 4-substituted cyclohexyne as a common intermediate. The cyclohexyne formation was confirmed by deuterium labeling and trapping to lead to [4 + 2] cycloadducts and a platinum-cyclohexyne complex. Cyclohexyne can also be generated in the presence of some other mild bases such as fluoride ion, alkoxides, and amines, though amines are less effective bases for the elimination. Kinetic deuterium isotope effects show that the anionic bases induce the E2 elimination ($k_H/k_D > 2$), while the amines

allow formation of a cyclohexenyl cation in chloroform to lead to E1 as well as S_N1 reactions ($k_H/k_D \approx 1$). Bases are much less effective in methanol, and methoxide was the only base to efficiently afford the cyclohexyne intermediate. Nucleophiles react with the cyclohexyne to give regioisomeric products in the ratio dependent on the ring substituent. The observed regioselectivity of nucleophilic addition to substituted cyclohexynes is rationalized from calculated LUMO populations, which are governed by the bond angles at the acetylenic carbons: The less deformed carbon has a higher LUMO population and is preferentially attacked by the nucleophile.

Vibrational Analysis with the Symmetrically Combined Morse Potential Model for Antisymmetric Stretching in [ClDCl] Formed by Photodissociation of $(DCl)_2$, Masaki MITANI, Yasunori YOSHIOKA, Dock–Chil CHE*, Toshio KASAI* : J. Phys. Chem. A 108 (24), pp.5220-5225, 2004

We estimate the line spacing between vibrational levels for the antisymmetric stretching in [ClDCl] to elucidate the origin of the oscillating structure on the translational energy distribution of the terminal D atom released by the photodissociation of $(DCl)_2$. The vibrational analysis with the symmetrically combined Morse potential model is performed for linear hydrogen-bonding [ClDCl] and the dependence of change in vibrational levels on the Cl–Cl distance is examined. It is found that the calculated assignment and observed spacing show good correspondence for R_{ClCl} = 3.65 or 3.70 Å, and it is therefore strongly suggested that the oscillation of dissociated D translational energy reflects the antisymmetric stretching vibration in the [ClDCl] counterpart.

Effect of Aging on Conductivity of Yttria Stabilized Zirconia, Masatoshi HATTORI*, Yasuo TAKEDA, Yoshinori SAKAKI*, Akihiro NAKANISHI*, Satoshi OHAR*, Kazuo MUKAI*, Jin-Ho LEE*, Takehisa FUKUI*: Journal of Power Sources 126, pp.23-27, 2004
Effect of Annealing on the Electrical Conductivity of the Y_2O_3-ZrO_2 System, M. HATTORI*, Y. TAKEDA, J. –H. LEE*, S. OHARA*, K. MUKAI*,T. FUKUI*, S. TAKAHASHI*, Y. SAKAKI*, A. NAKANISHI*: Journal of Power Sources 131, pp.247-250, 2004

The Effect of Doped Elementals on the Electrochemical Behavior of Hexagonal $Li_{2.6}Co_{0.4}N$, Yu LIU, Kumi HORIKAWA, Minako FUJIYOSHI, Nobuyuki IMANISHIi, Atsushi HIRANO, Yasuo TAKEDA: Journal of the Electrochemical Society 151(9), pp. A1450-A1455, 2004

Lithium Transition Metal Nitrides with the Modified Morphology Characteristics as Advanced Anode Materials for Lithium Ion Batteries, Y. LIU, T. MATSUURA, N. IMANISHI, T. ICHIKAWA, A. HIRANO, Y. TAKEDA: Electrochemistry Communication 6, pp.632-636, 2004

Silicon/Carbon Composites as Anode Materials for Li-Ion Batteries, Y. LIU, K. HANAI, J. YANG*, N. IMANISHI, A. HIRANO, Y. TAKEDA: Electrochemical and Solid-State Letters 7(10), pp.A369-A372, 2004

Study of the Capacity Fading Mechanism for Fe-Substituted $LiCoO_2$ Positive Electrode, Victoria L. MCLAREN*, Anthony R. WEST*, Mitsuharu TABUCHI*, Akiko NAKASHIMA*, Hikari TAKAHARA*, Hironori KOBAYASHI*, Hikari SAKAEBE*, Hiroyuki KAGEYAMA*, Atsushi HIRANO, Yasuo TAKEDA: Journal of the Electrochemical Society 151(5), pp. A672-A681, 2004

Novel Composite Anodes Based on Layered Lithium Transition Metal Nitrides for Lithium Secondary Batteries, Y. LIU, K. HORIKAWA, M. FUJIYOSHI, T. MATSUURA, N. IMANISHI, Y. TAKEDA: Solid State Ionics 172, pp.69-72, 2004

Electrical and Thermal Properties of Dense $Ce_{1-x}RE_xO_{2-\delta}$ Electrolyte Using Low-Temperature Sinterable Powder ($0 \leq x \leq 0.2$, RE=Y, Sm, Gd), Eisaku SUDA*, Bernard PACAUD*, Yvan MONTARDI*, Masashi MORI*, Yasuo TAKEDA: Transactions of the Materials Research Society of Japan 29(5), pp.2317-2320, 2004

Impedance Spectroscopy of Perovskite Air Electrodes for SOFC Prepared by Laser Ablation Method, N. IMANISHI, T. MATSUURA, Y. SUMIYA, K. YOSHIMURA, A. HIRANO, Y. TAKEDA, D. MORI*, R. KANNO*: Solid State Ionics 174, pp.245-252, 2004

Effects of Charge Disproportionation on the Phonon Density of State in Fe Perovskites, Jobu MATSUO*, Makoto SETO*, Shinji KITAO*, Yasuhiro KOBAYASHI*, Rie HARUKI*, Takaya MITSUI*, Atsushi FUJIMORI*, Yasuo TAKEDA, Shuji KAWASAKI*, Mikio TAKANO*: Journal of the Physical Society of Japan 73 (10), pp.2768-2770, 2004

Modification of Carbon Nanotubes by Laser Ablation of Copper, Akira. KOSHIO, Mitsuru SHIRAISHI, Yuuji KOBAYASHI, Masatou ISHIHARA*, Yoshinori KOGA*, Syunji BANDOW*, Sumio IIJIMA*, Fumio KOKAI: Chem. Phys. Lett. 396, pp.410-414, 2004

Multi-wall carbon nanotubes (MWNTs) were modified by laser ablation of Cu in the presence of He gas. Quasi-spherical particles with diameters of 200 nm to 2 μm were sparsely deposited on as-grown MWNTs. Agglomerated nanoparticles with sizes of 1-10 nm covered ultrasonically-treated MWNTs. Both particles were oxidized. The interaction of nanoparticles with the surface of the ultrasonicated MWNTs, due to small charge transfer to carbon atoms of the MWNTs upon adsorption of Cu, was suggested. We discuss the size distribution and morphology of the particles from cluster and particle formation in gas-phase and the surface properties of the two MWNTs.

Compression of Polyhedral Graphite up to 43 GPa and X-ray Diffraction Study on Elasticity and Stability of the Graphite Phase, Atsuko NAKAYAMA*, Sumio IIJIMA*, Yoshinori KOGA*, Katsuya SHIMIZU*, Kaori HIRAHARA*, Fumio KOKAI: Appl. Phys. Lett. 84, pp. 5112-5114, 2004

The crystal structure of polyhedral graphite particles ("G balls") has been investigated under pressure up to 43 GPa and at room temperature by x-ray powder diffraction measurements. The polyhedra maintain the graphite phase under pressure higher than 40 GPa. A 29% compression in volume at 43 GPa involves an unusual decrease in the interlayer distance of 25%. The polyhedra recover their original crystal structure by releasing the pressure. A closed and solid structure of the polyhedra, suppressing a transition into another phase, causes them to become metallic under pressure higher than 20 GPa.

Three Nanostructured Graphitic Particles and their Growth Mechanisms from High-Temperature Carbon Vapor Confined by Ar Gas, Fumio KOKAI, Akira KOSHIO, Daisuke KASUYA*, Kaori HIRAHARA*, Kunimitsu TAKAHASHI*, Atsuko NAKAYAMA*, Masatou ISHIHARA*, Yoshinori KOGA*, Sumio IIJIMA*: Carbon, 42, pp.2515-2520, 2004

CO_2 laser vaporization of graphite was carried out in the presence of high pressure Ar gas up to 0.8 MPa. We compared transmission electron microscope images and Raman spectra of deposited particles and luminous laser plumes of vaporized and clustered carbon species. We discuss the growth mechanisms of three graphitic carbon particles, a single-wall carbon nanohorn aggregate, a platelet graphite particle, and a polyhedral graphite particle, grown depending on the confinement of the Ar atmosphere. The formation of graphitic sheet or shell structures, dependent on resident carbon densities and their temperature gradient, is thought to begin from supersaturated hot carbon vapor up to about 3000°C and lead to the growth of the three graphitic particles.

Optimization of Solar Photocatalytic Degradation Conditions of Bisphenol A in Water Using Titanium Dioxide, Satoshi KANECO, Mohammad A. RAHMAN, Tohru SUZUKI, Hideyuki KATSUMATA, Kiyohisa OHTA: J. Photochem. Photobiol. A: Chem. 163, pp. 419–424, 2004

Solar Photocatalytic Degradation of Bisphenol A in Water with ZnO, Mohammad A. RAHMAN, Satoshi KANECO, Tohru SUZUKI, Hideyuki KATSUMATA, Kiyohisa OHTA: Photo/Electrochem. Photobiol. Environ. Energy Fuel 3, pp. 199–205, 2004

Determination of Silver in Waters by Tungsten Wire Preconcentration Method - Electrothermal Atomic Absorption Spectrometry, Mohammad A. RAHMAN, Satoshi KANECO, Md N. AMIN, Tohru SUZUKI, Kiyohisa OHTA: Talanta 62, pp. 1047–1050, 2004

Separation of Zinc Compounds by Sequential Metal Vapor Elution Analysis with Atomic Absorption Detection, Mohammad A. RAHMAN, Satoshi KANECO, Tohru SUZUKI, Hideyuki KATSUMATA, Kiyohisa OHTA: Talanta 64, pp. 989–992, 2004

Slurry Sampling for Direct Analysis of Lead in Bangladeshi Vegetable Samples by Molybdenum Electrothermal Atomizer Atomic Absorption Spectrometry, Mohammad A. RAHMAN, Satoshi

KANECO, Tohru SUZUKI, Hideyuki KATSUMATA, Kiyohisa OHTA: ITE Lett. Batt. New Technol. Med. 5, pp. 363–368, 2004

Leaching Behavior of Lead Compounds in Atmosphere Fine and Coarse Particles, Kunihiro FUNASAKA*, Takeji MIYAZAKI*, Toshikazu KAMIURA*, Joji FUKUYAMA*, Hideyuki KATSUMATA, Satoshi KANECO, Tohru SUZUKI, Kiyohisa OHTA: ITE Lett. Batt. New Technol. Med. 5, pp. 577–580, 2004

Development of Sintering Preparation Technology of Porous Materials from Sea Bottom Sediments for Waste Water Treatment, Satoshi KANECO, Takuya HARADA, Ahmed H.A. DABWAN, Tohru SUZUKI, Hideyuki KATSUMATA, Kiyohisa OHTA: ITE Lett. Batt. New Technol. Med. 5, pp. 467–471, 2004

Electrochemical Reduction of CO_2 at Alloy Electrode in Methanol, Satoshi KANECO, Hiroki YAMAUCHI, Hideyuki KATSUMATA, Tohru SUZUKI, Kiyohisa OHTA: Stud. Surf. Sci. Catal. 153, pp. 277–282, 2004

Reduction of Carbon Dioxide Using Metal Powders, Hideyuki KATSUMATA, Kouichirou MATSUSHITA, Satoshi KANECO, Tohru SUZUKI, Kiyohisa OHTA: Stud. Surf. Sci. Catal. 153, pp. 55–60, 2004

Long Term Sampling Method for PCDD/Fs in Atmosphere by Adsorption onto Economical Materials, Hideyuki KATSUMATA, Satoshi KANECO, Tohru SUZUKI, Kiyohisa OHTA: Chem. Lett. 33, pp. 1618–1619, 2004

Effect of Metal Nitrates on the Formation of PCDD/Fs during Newspaper Combustion, Hideyuki KATSUMATA, Satoshi KANECO, Tohru SUZUKI, Kiyohisa OHTA: Bull. Environ. Contamn. Toxicol. 73, pp. 479–486, 2004

Removal of Humic Substances and Their Metal Complexes by Adsorption with Bone Char, Hideyuki KATSUMATA, Satoshi KANECO, Haruna KASAI, Kumiko ITOH, Kazuaki MASUYAMA*, Tohru SUZUKI, Kunihiro FUNASAKA*, Kiyohisa OHTA: Environ. Eng. Sci. 21, pp. 341–348, 2004

Microbial Metabolism of Di-*n*-Butyl Phthalate by Bacterium *Bacillus Natto*, Aleya BEGUM, Hideyuki KATSUMATA, Satoshi KANECO, Tohru SUZUKI, Kiyohisa OHTA: Chem. Lett. 33, pp. 682–683, 2004

Removal of Heavy Metals in Aqueous Solution by Adsorption onto Oyster Shell, Hideyuki

KATSUMATA, Satoshi KANECO, Tohru SUZUKI, Kiyohisa OHTA, Yoshihiro YOBIKO: Photo/Electrochem. Photobiol. Environ. Energy Fuel 3, pp. 165–172, 2004

Removal of Heavy Metals in Water by Adsorption onto Sintering Porous Materials from Sea Bottom Sediments, Hideyuki KATSUMATA, Takuya HARADA, Satoshi KANECO, Ahmed H.A. DABWAN, Tohru SUZUKI, Kiyohisa OHTA: ITE Lett. Batt. New Technol. Med. 5, pp. 573– 576, 2004

Preconcentration of Phthalic Acid Esters in Water Samples by *Saccharomyces cerevisiae* Immobilized on Silica Gel, Hideyuki KATSUMATA, Aleya BEGUM, Satoshi KANECO, Tohru SUZUKI, Kiyohisa OHTA: Anal. Chim. Acta 502, pp. 167–172, 2004

Degradation of Bisphenol A in Water by the Photo-Fenton Reaction, Hideyuki KATSUMATA, Shinsuke KAWABE, Satoshi KANECO, Tohru SUZUKI, Kiyohisa OHTA: J. Photochem. Photobiol. A: Chem. 162, pp. 297–305, 2004

Nucleotide Sequence Analysis of *p10* Gene of *Antheraea pernyi* Nucleopolyhedrovirus and Construction of Two Transfer Vector Plasmids, Kenichi MAEGAWA, Xie T. WANG*, Jun KOBAYASHI*, Tetsuro YOSHIMURA: International Journal of Wild Silkmoth and Silk 9, pp. 53-60, 2004

Development of Orally Administrated Liposome Vaccines against Bacteria- and Virus-Infectious Diseases in Cultured Fishes: Tetsuro YOSHIMURA, Takeyoshi TAKAGI, Kanta TSUMOTO, Masayuki SHONO, Teruo MIYAZAKI: Immunology 2004, pp. 225-228, 2004

Ligand-Printed Ion Pore Composed of Polypeptide Assembly in a Lipid Bilayer Membrane, Masahiro HIGUCHI, Tomoyuki KOGA*, Yoshiaki KOBUKE*, Takatoshi KINOSHITA*, Masami KAWAGUCHI: Trans. MRS-J. 29, pp. 3143-3146, 2004

A simple and novel approach for the preparation of a synthetic ligand-gated ion channel was investigated. The ligand-induced formation of an amphiphilic polypeptide assembly acts as an ion channel in lipid bilayer membrane. Various functional groups, which bind to the specific site on the ligand (X), were introduced at the amino terminal of α-helical polypeptide. The interaction between the ligand (X) and the terminal groups of the polypeptides induced the specific location of the α-helical polypeptide rods. Removing of the ligand (X) provided the ligand-printed ion pore in the membrane, while re-binding of the ligand (X) closed the pore. Another ligand (Y) was inactive to the ligand (X)-printed ion pore, *i.e.*, it did not close the channel. This ligand-printed polypeptide assembly may permit a novel and easier production of the ligand-gated ion channel, which will give a novel approach for the construction of signal transduction molecular devices.

Viscous Fingering of Silica Suspensions Dispersed in Polymer Fluids, Masami KAWAGUCHI: ACS Symposium Series No. 869 Nonlinear Dynamics in Polymeric Systems, pp. 250-261, 2004

Experimental studies of the viscous fingering of shear shinning silica suspensions in a radial Hele-Shaw cell and shear thickening silica suspensions in a linear Hele-Shaw cell were performed by the injection of air. For the shear thinning silica suspensions, the instability, namely changes in the viscous fingering pattern, was strongly related to the polymer concentration in the dispersant rather than the silica concentration. For the shear thickening silica suspensions, the imposed shear rate at which the instability was first observed, was close to the critical shear rate of the corresponding silica suspension. The finger velocities of the shear thinning silica suspensions were in agreement with the modified Darcy's law, while those of the shear thickening silica suspensions with the silica concentrations higher than 7.5 wt% were much lower than the prediction of the modified Darcy's law.

Rheo-Optical Properties of Silicone Oil Emulsions in the Presence of Polymer Emulsifiers, Masami KAWAGUCHI, Kenji KUBOTA: Langmuir 20 (4), pp. 1126-1129, 2004

Oil in water emulsions were prepared by dispersion of silicone oils into an aqueous solution of hydroxylpropyl methyl cellulose (HPMC) or poly(ethylene oxide) (PEO)-poly(propylene oxide) (PPO)-PEO block copolymers. The emulsions were characterized by measurements of steady-state shear viscosities, dynamic moduli, and stress-strain sweep curves coupled with optical microscope observation. The emulsions emulsified by HPMC showed solid-like viscoelastic responses, while the emulsions prepared by the block copolymers indicated liquid-like viscoelastic behavior. The simultaneous optical microscopic observation showed that the emulsions stabilized by HPMC did not flow below the yield stress, while those by the block copolymers did flow.

Viscous Fingering Instabilities in an Oil in Water Emulsion, Masami KAWAGUCGHI, Sayaka YAMAZAKI, Tadaya KATO: Phys. Fluids 16 (6), pp. 1908-1914, 2004

Viscous fingering of silicone oil emulsion stabilized by hydroxylpropyl methyl cellulose (HPMC) in water was performed by the injection of water and an aqueous solution of HPMC as a function of the injection rate. The pressure imposed at the finger tip was simultaneously monitored. Changes in the viscous fingering patterns from a crack-like pattern to a ramified one through a cups-like one were observed with an increase of the injection rate, irrespective of the injected fluid. Such a pattern transition was strongly related to rheological properties of the emulsion. Moreover, the finger velocities of the emulsion were in agreement with the modified Darcy's law

Structure Study of Binary Titanophosphate Glasses Prepared by Sol-Gel and Melting Methods, Anjiang TANG, Tadanori HASHIMOTO, Tetsuya NISHIDA, Hiroyuki NASU, Kanichi KAMIYA: Journal of the Ceramic Society of Japan 112(9), pp. 496-501, 2004

The $70TiO_2 \cdot 30P_2O_5$ (mol%) glass was prepared by the sol-gel method. Its structure was examined by means of IR, Raman spectroscopy and X-ray radial distribution function analysis, and was compared with the corresponding melt-derived glass. It was found that average coordination number of Ti^{4+} ions was almost 6 and Ti^{4+} ions formed predominantly TiO_6 octahedra in the

sol-gel-derived glass, while Ti^{4+} ions were present in the 4, 5 and / or 6-fold coordination states to give average coordination number in-between 4 and 5 in the melt-glass. The preference of high coordination state of Ti^{4+} ions in the sol-gel glass was consistent with higher refractive index and density than the melt-glass.

Effective Deposition of Nano-Sized Silver Particles on Silica to Develop a Sensitive Local Plasmon-Based SPR Sensor, Noritsugu HASIMOTO*, Tadanori HASHIMOTO, Koichi MORI, Hiroyuki NASU, Kanichi KAMIYA: Journal of the Ceramic Society of Japan, Supplement 112-1, PacRim5 Special Issue 112(5), pp. S576-S578, 2004

Nano-sized silver particles-deposited silicas were prepared by (a) the sol-gel method, the evaporation-condensation of silver on (b) silica glass and (c) sol-gel derived silica film. Optical absorption peak due to surface plasmon resonance (SPR) of silver particles was measured using UV-VIS spectrophotometer. When the films were immersed in liquid, SPR absorption peak of the films (b) and (c) was shifted toward longer wavelength with the increase of the refractive index of the liquid, suggesting that these films can be used as optical sensors. On the other hand, SPR absorption peak of the film (a) was little shifted. The sensitivity to the refractive index change for the film (b) was 81.4 nm, and that of the film (c) made by depositing silver particles on the sol-gel silica was large as 90.2 nm, which may be attributed to less coverage of silver particles with silica matrix than the film (a) and less aggregate of them than the film (b).

Optical Properties of Ti^{3+}-Free Ternary Titanophosphate Glasses, Tadanori HASHIMOTO, Hiroyuki NASU, Kanichi KAMIYA: Proceedings of the XX ICG in Kyoto, Sep.27th-Oct.1st, O-07-085, 2004

The Ti^{3+}-free binary TiO_2-P_2O_5 glasses containing TiO_2 up to 74 mol% prepared by the melt-quenching and a long-term post-annealing around the glass transition temperature in the air possess high transparency, high-index, high-dispersion and low density, and are expected as novel eco-optical glasses. In the present study, the effect of third and fourth components on the time of post-annealing to remove Ti^{3+} ions, and linear and nonlinear optical properties was examined. The substitution of K_2O for P_2O_5 in binary glasses shortened the post-annealing time and decreased the thermo-optic coefficient. The addition of a small amount of SnO_2 to binary glasses was found to be effective for removing Ti^{3+} ions, or decoloration of glasses with maintaining high-index, and also for stabilizing laser pulses. In addition, quaternary Li_2O-ZnO-TiO_2-P_2O_5 glasses were expected as high-index molding glasses.

Structure Study of TiO_2-P_2O_5 Glasses Prepared by Sol-Gel Method, Anjiang TANG, Tadanori HASHIMOTO, Hiroyuki NASU, Kanichi KAMIYA: Proceedings of the XX ICG in Kyoto, Sep.27th-Oct.1st, O-10-021, 2004

The $xTiO_2 \cdot (100\text{-}x)P_2O_5$ (x = 70-95 mol%) glasses with refractive indicies as high as 2.1-2.3 were prepared by the sol-gel method. The refractive index was higher in the sol-gel-glass than in the melt-glass at x = 70. Heat-treated compositions with x = 90 and 95 were considered to be composites of 13-15 mass% nano-sized anatase and glass matrices with x slightly smaller than nominal values,

but were highly transparent. It was found by IR and Raman techniques that 6-fold coordinated Ti^{4+} ions are predominant in the glass phase, while 4 or 5, and 6-fold ones are coexisting in the melt-glass of x = 70. These results were consistent with very high refractive index of the sol-gel glasses.

Influences of Nanocrystal-Size and Matrix on Third-Order Optical Nonlinearity for Thin Films Prepared by RF-Sputtering, Hiroyuki NASU, Akimasa TANAKA, Tadanori HASHIMOTO, Kanichi KAMIYA, Kenji KAMADA*: Proceedings of the XX ICG in Kyoto, Sep.27th-Oct.1st, O-16-017, 2004

CdSe microcrystals with various size was successfully embedded in various glass matrices by magnetron Rf sputtering technique. The mean size of microcrystals was controllable by changing the relative surface ratio of CdSe pellets to the matrix in the target, and increased with increasing the relative area. The negative real part of the third-order optical susceptibility was seen for the all present films, and magnitude of the absolute value of real part in the same glass matrix increased with decreasing microcrystal size. On the other hand, the increase of the dielectric constant of the matrix increase the magnitude. Therefore it is interpreted that the strengthening the quantum size effect increase the magnitude of the real part of the third-order optical nonlinearity. Furthermore, even taking account of the imaginary part, it is evident that the strengthening the quantum size effect increases total third-order optical nonlinearity.

Electroluminescence from CdSe Nanocrystal-Doped ITO Films on SiO_2 Glass Substrates, Hiroyuki NASU, Yasuhiro Matsuzaki, Tadanori HASHIMOTO, Kanichi KAMIYA: Proceedings of the XX ICG in Kyoto, Sep.27th-Oct.1st, O-16-025, 2004

Electroluminescence was observed in CdSe microcrystal-doped indium tin oxide (ITO) thin films on SiO_2 glass substrates by Rf-sputtering method. The size of CdSe microcrystals was changed by altering the relative surface area of the CdSe pellets on the ITO target. ITO was well crystallized on SiO_2 glass substrates. Emission spectra shifted from red to yellow with decreasing CdSe microcrystal size. The shift was considered to result from the blue shift of the absorption edge caused by the quantum confinement effect of CdSe microcrystals.

Review of Combination of Peritoneal Dialysis and Hemodialysis as a Modality of Treatment for End-stage Renal Disease, H. FUKUI*, S. HARA*, Y. HASHIMOTO*, T. HORIUCHI, M. IKEZOE*, N. ITAMI*, M. KAWABE*, H. KAWANISHI*, Y. KIMURA*: Ther Apher Dial 8, pp. 56-61, 2004

Because the contribution of residual renal function (RRF) to total solute clearance is often significant in continuous ambulatory peritoneal dialysis (CAPD), loss of RPF over time can lead to inadequate dialysis if appropriate prescription management strategies are not pursued. Additionally, declines in ultrafiltration caused by increases in peritoneal permeability may limit continuation of CAPD therapy. Peritoneal dialysis and hemodialysis (PD+HD) combination therapy (complementary dialysis therapy) is an alternative method. This therapy allows the patient to maintain daily activities, as with CAPD, while undergoing once-a-week HD supplements for the insufficient removal of solutes and water. This therapy allows for the continuation of PD without shifting to total HD in PD patients who continue to have uremic symptoms even after individualization of the PD prescription.

This treatment option is psychologically more acceptable to patients and may be expected to provide such accompanying beneficial effects as peritoneal resting, impravement of QOL and reduction in medical cost.

Department of Architecture

*nonmember

Characteristics of The Learning Room Use of Environmental Education Facilities from the Viewpoint of Learning Programs Execution - A Study on The Relation between Learning room/equipments and Learning Programs at Environmental Education Facilities Part1-[in Japanese], Hiroki OGAWA and Masuro URAYAMA, Journal of Architecture and Planning, No.581, pp.33-40, 2004.7

This paper clarifies the relation between learning rooms and learning programs of environmental education facilities. Main results are as follow;
1. There are many learning programs of interest or knowledge stage, and a few one of action or understanding stage. Many facilities carry out programs of the only interest stage. But more than half execute learning programs which have a combination of some aim stages.
2. From the equipments of learning room, the use form of leaning room is classified in lecture, training, teaching materials and exhibition. Learning programs of using the plural room are able to achieve a higher stage than ones of the single room use.

A Study on Forming Civic Center and Urban Renewal in Prefectural Capital Cities based on Japanese Castle-Towns in the Meiji and Taisho era. [in Japanese], Kenjiro MATSUURA, Yoshihiro YOKOTA , Satoshi KUSAKABE , Masuro URAYAMA and Shigeru SATOH : Jounal of Architecture and Planning , Transactions of Architectural Institute of Japan, No. 581, p.p. 67-74, 2004. 7

This paper aims to clarify how to form Civic Center for Urban Renewal analyzing cases of prefectural capital 27 Cities based on Japanese Castle-Towns in the Meiji and Taisho era.

Findings are as follows : 1) Government and municipal offices tended to be nearby castle and gather each other to form Civic Center , 2)Just after replacing feudal domain system with prefecture system and operation of city organization system , there were many cases of conversion of existing institutions to prefectural offices and city offices , 3)Nearby Civic Center , Castle Renewal such as reclaiming moats and creating new roads was done in many cities.

A Study on Visual Impacts of Windfarm -On Influences of Windmills Arrangement to Landscape Evaluation-[in Japanese], Shinjiro SAKAMOTO, Fumiko KAMIYA and Masuro URAYAMA, Papers on Environmental Information Science, No.18, pp1-6, 2004.11

The purpose of this study is to analyze visual impacts of windmills arrangement to landscape evaluation. We prepared CG pictures which were drawn in combination of layout, distance from standpoint to windmills and distance between windmills. 48 students evaluated these pictures with 10 adjective scales. We found 3 factors of landscape evaluation, and analyzed the relation between them and windmill arrangement.

MANAGEMENT OF A COMMUNITY FACILITY CONVERTED VACANT SHOP AT THE CENTRAL DISTRICT OF A LOCAL SMALL TOWN AND ITS EFFECTS -Through a social experiment at Kamiichi in Yoshino Town, Nara prefecture-[in Japanese], Hiroki KAWAKITA and Masuro URAYAMA, AIJ Journal of Technology and Design, No.20, pp. 319-324, 2004.12

As it is required to develop a management system of vacant shops at central district of local small towns, this paper reports the challenge for local residents group to convert a vacant shop to a community facility, and management of it at Kamiichi district of Yoshino Town, Nara Prefecture. This facility offered only a place to local people at beginning. After changing to sponsor various use opportunities, this came to be use positively, and made local people feel liveliness. To keep these effects, it is subject to be secured so that maintenance administrative expenses can be paid for local residents group, and attractive use opportunities can continue being sponsored.

A Study on the Transfiguration of the Landscape Ordinance in the Prefectures, Yoshio BANDO, Satoshi ASANO and Shoji IMAI, Journal of Architecture and Planning, No.578, pp.85-92, 2004

The Actual Conditions of the Acceptance and Evaluation of Users for Housing Performance Indication System (Apartment Houses) in Housing Quality Assurance Act [in Japanese], Hiroyuki Takai, Urban Housing Scieces, No.47, pp.95-100, 2004

The aim of this research is to make clear the acceptance condition and evaluation of users for Housing Performance Indication System (Apartment houses) in Housing Quality Assurance Act. The research was made for 210 residents living in the apartment houses adopted the system, and it was found that the system contributes to users ' choosing houses much. But there are some problems. For example more popularization of the system and more information easy to understand and useful to judge for users are needed.

A Study on the Successive Change Condition of Common Facilities in Condominiums Including Many Units [in Japanese], Yuki Miyauchi , Hiroyuki Takai , Mitsuo Takada* , Hiroko Saito*, Urban Housing Scieces, No.47, pp.41-46, 2004

The aim of this research is to make clear the actual condition on successive change of common spaces and facilities in condominiums including many units. The research was made for 40 housing estates in Kansai and Tokyo Metropolitan area by the way of questionnairs to the chief of homeowners association or the management staff and hearing on 3 housing estates. So big change is not occurred yet, but we can find many symptoms. We could find variety of repeated trial and error and changes keep up with an aging repairs costs and management costs.

Improvement of Quality of Concrete with Permeable Form [in Japanese], Naoki MISHIMA, Shigemitsu HATANAKA, Hiromi KOBAYASHI* and Toshitsugu INUKAI, Proceedings of the

Japan Concrete Institute, Vol.26, No.1, pp.363-368, 2004.7

Influence of Magnitude of Pressure for Vacuum Processing on Strength Distribution in Concrete Slab [in Japanese], Hiroshi WATO, Shigemitsu HATANAKA, Naoki MIAHIMA and Akio MURAMATSU*, Proceedings of the Japan Concrete Institute, Vol.26, No.1, pp.375-380, 2004.7

Fundamental Study on Bleeding Behavior in Concrete by Visible Evaluation Method [in Japanese], Toshitsugu INUKAI, Shigemitsu HATANAKA, Naoki MISHIMA and Rinji KANEKO*, Proceedings of the Japan Concrete Institute, Vol.26, No.1, pp.609-614, 2004.7

Fundamental Study on Compaction Mechanism Based on the Consolidation Theory [in Japanese], Hiroki HATTORI, Shigemitsu HATANAKA, Eisuke SAKAMOTO and Naoki MISHIMA, Proceedings of the Japan Concrete Institute, Vol.26, No.1, pp.1227-1232, 2004.7

Visualized Experiment on Air Bubbles Behavior in Concrete of Vacuum-processed Process [in Japanese], Eisuke SAKAMOTO, Shigemitsu HATANAKA, Hiroki HATTORI and Naoki MISHIMA , Proceedings of the Japan Concrete Institute, Vol.26, No.1, pp.1233-1238, 2004.7

Influence of Paste Strength on Compressive Strength of Porous Concrete [in Japanese], Yukihisa YUASA*, Shigemitsu HATANAKA, Naoki MISHIMA and Ken MURAO*, Proceedings of the Japan Concrete Institute, Vol.26, No.1, pp.1425-1430, 2004.7

Fundamental Study on Manufacture of Large Particle Porous Concrete Using Concrete Rubble [in Japanese], Akihiro MAEGAWA, Shigemitsu HATANAKA, Naoki MISHIMA and Yukihisa YUASA*, Proceedings of the Japan Concrete Institute, Vol.26, No.1, pp.1455-1460, 2004.7

Uniaxial Compression 3-D FEM Analysis of Cylindrical Concrete Specimens with Different Shape Ratios [in Japanese], Yukio YOSHIDA, Eiji MIZUNO* and Shigemitsu HATANAKA, Proceedings of the Japan Concrete Institute, Vol.26, No.2, pp.19-24, 2004.7

Analytical Study on Confining Effect Inside Confined Concrete Subjected to Axial Compressive Force [in Japanese], Makoto ITO*, Eiji MIZUNO* and Shigemitsu HATANAKA, Proceedings of the Japan Concrete Institute, Vol.26, No.2, pp.31-36, 2004.7

Fundamental Study on Rotation Condition of Shear Wall in Seismic Evaluation of RC Buildings [in Japanese], Kenzo KUBOTA Shigemitsu HATANAKA and Yoshiyuki KATO*, Proceedings of the Japan Concrete Institute, Vol.26, No.2, pp.1327-1332, 2004.7

Fundamental Study on Compaction Mechanism of Vacuum Processing Method Based on the Consolidation Theory [in Japanese], Hiroki HATTORI, Shigemitsu HANATANA, Naoki MISHIMA and Eisuke SAKAMOTO, J. Struct. Constr. Eng. AIJ, No.585, pp.7-13, 2004.11

The strength and hardness of concrete slab surface is considered significantly affected by bleeding of concrete. It has been reported that dewatering by vacuum processing is quite effective to make concrete high density and high strength. The method, however, has not been successfully used for the concrete works in the field of building construction, compared with that of civil engineering works in Japan. In the earlier report, the authors have already pointed out that there is a strong relationship between the strength distribution and density distribution in the vacuum processed concrete, both gradually decreasing from the top surface to about 15 cm depth of concrete. Main purpose of the present study is to discuss the mechanism of the occurrence of such distribution of strength and density, based on consolidation theory. In the experiment, pore water pressure distribution in concrete has been measured using the original measuring system. As a result, it has been confirmed that the consolidation theory is quite effective to explain the internal properties of vacuum processed concrete as well as those of press-dewatered concrete.

EXPERIMENTAL STUDY ON ELASTICS-PLASTIC BEHAVIOR AND ULTIMATE STRENGTH OF EXPOSURE FIXED-TYPE STEEL COLUMN-BASE SUBJECTED TO BENDING MOMENT [in Japanese], Haruyoshi Kadoya*, Jun Kawaguchi and Shosuke Morino, Journal of Structural and Construction Engineering, Number 583, pp.123-130, 2004.9.

Experimental Study on Strength and Stiffness of Bare Type CFT Column Base with Central Reinforcing Bars, Haruyoshi Kadoya*, Jun Kawaguchi and Shosuke Morino, COMPOSITE CONSTRUCTION IN STEEL AND CONCRETE V, pp.1-10, 2004.

Dynamic response of steel beam-columns with square hollow section - Shaking table tests of steel beam-columns subjected to biaxial bending (part 1), Yasuhiro Uchida*, Jun Kawaguchi and Shosuke Morino, Journal of Structural and Construction Engineering, Number 577, pp.123-130, 2004.3.

Structural design of frame structures by means of a multiobjective genetic algorithm, Toyofumi TAKADA and Keigo MATSUSHIMA, Proc. of the 4th Int. Conf. on Engineering Computational Technology (CD-ROM), paper 104, 2004

Simplified Design Method for Air-based Solar Heating System [in Japanese], Hiroaki KITANO and Kazunobu SAGARA*, Journal of Enviromental Engineering, No.582, pp.45-52, 2004.8

Reducing Effect of Fresh Air Latent Heat Load in Air to Earth Heat Exchange using Underground Double Floor Space, Wontug SON, Hisaya NAGAI, Journal of Asian Architecture and Building Engineering, Vol.3, No.2,pp.29-34, 2004

Department of Information Engineering

*nonmember

The Joinability and Unification Problems for Confluent Semi-Constructor TRSs , Ichiro MITSUHASHI, Michio OYAMAGUCHI, Yoshikatsu OHTA and Toshiyuki YAMADA, Proceedings of the 15th International Conference on Rewriting Techniques and Applications (RTA 2004), Lecture Notes in Computer Science 3091, pp.285-300, June 2004.

The unification problem for term rewriting systems (TRSs) is the problem of deciding, for a TRS R and two terms s and t, whether s and t are unifiable modulo R. Mitsuhashi et al. have shown that the problem is decidable for confluent simple TRSs. Here, a TRS is simple if the right-hand side of every rewrite rule is a ground term or a variable. In this paper, we extend this result and show that the unification problem for confluent semi-constructor TRSs is decidable. Here, a semi-constructor TRS is such a TRS that every subterm of the right-hand side of each rewrite rule is ground if its root is a defined symbol. We first show the decidability of joinability for confluent semi-constructor TRSs. Then, using the decision algorithm for joinability, we obtain a unification algorithm for confluent semi-constructor TRSs.

Inductive Theorems for Higher-Order Rewriting, Takahito AOTO*, Toshiyuki YAMADA and Yoshihito TOYAMA*, Proceedings of the 15th International Conference on Rewriting Techniques and Applications (RTA 2004), Lecture Notes in Computer Science 3091, pp.269-284, June 2004.

Simply typed term rewriting proposed by Yamada (2001) is a framework of higher-order term rewriting which dispenses with bound variables. This paper proposes an extention of the dependency pair method of first-order term rewriting introduced by Arts and Giesl (2000), which enables automated termination proof of simply typed term rewriting systems.

Improvements on SIMD Macroblock Processor in MPEG-2Video Encoder LSI, Koyo NITTA*, Takeshi YOSHITOME*, Toshio KONDO, Hiroe IWASAKI* and Jiro NAGANUMA*: Trans. of IEICE, Vol.J87-C, No.4, pp.377-385,2004

Low Energy Consumption by a Variable Stages Pipeline Technique, Yuji Ichikawa*, Takahiro Sasaki, Tetsuo Hironaka*, Toshiaki Kitamura*, Toshio Kondo: International Technical Conference on Circuits/Systems, Computers and Communications, 2004

Proposition and Evaluation of a Bank based Multi-port Memory with Blocking Network, Tomohiro Inoue*, Tetsuo Hironaka*, Takahiro Sasaki, Seiji Fukae*, Tetsushi Koide*, Hans Jurgen Mattausch*: International Technical Conference on Circuits/Systems, Computers and Communications, 2004

Featuring vowels by five layers sandglass type neural network [in Japanese], Tadaaki SHIMIZU*,

Masaya KIMOTO*, Hiroki YOSHIMURA*, Naoki ISU, Kazuhiro SUGATA*: Brain Neural Net., Vol.11, pp.167-175, 2004.

We showed a new scheme to characterize speech from LSP parameters by 5 layers sandglass type nonlinear neural network (SNN(NL5)). In order to synthesize speech, we take advantage of useful abilities of SNN(NL5) for compressing and restoring the information. We performed learning experiments on LSP parameters of 5 vowels to investigate the ability of SNN. The followings were verified, 1) the distribution of LSP parameters compressed by SNN(NL5) are similar to the distribution of F1-F2 formants plane. 2) Nonlinear output function of neural elements in second and fourth layers of SNN(NL5) work effectively from view point of separating the distribution of vowels. 3) In order to prevent SNN(NL5) from over learning, there exists the optimum numbers of neural elements in second and fourth layers. For 14 orders of LSP parameters, this number was determined to be 20. 4) There is a preferable property on the plane to separate the vowels distinctively when the restoring error of LSP parameters becomes less. 5) SNN(NL5) can restore the LSP parameters with accuracy enough to synthesize speech from the compressed parameters.

An evaluation of question answering challenge (QAC-1) at the NTCIR workshop 3, Jun'ichi FUKUMOTO*, Tsuneaki KATO*, and Fumito MASUI: ACM SIGIR Forum, Vol.38, Issue 1, pp.25--28, 2004.6.

In this paper we describe the Question Answering Challenge (QAC), a question answering task, and its first evaluation (QAC1). The project was carried out as a task of the NTCIR Workshop 3 in October 2002. One objective of the QAC was to develop practical QA systems in a general domain by focusing on research relating to user interaction and information extraction. Our second objective was to develop an evaluation method for the question answering system and information resources for evaluation. We defined three kinds of tasks in the QAC: Task 1, where questions required five possible answers;, Task 2, where questions had a single answer; and Task 3 ,where there was one answer to a question related to a question in Task 2. We prepared 200 questions for Task 1 and Task 2 and 40 questions for Task 3 at the Formal Run and about 900 questions for the additional run. We conducted a Dry Run and a Formal Run evaluation. There were 16 participants (two of them from among the task organizers) at the QAC1.

A Method for Rating English Texts by Reading Level for Japanese Learners of English [in Japanese], Ryo NAGATA, Tatsuya IGUCHI, Fumito MASUI, and Atsuo KAWAI: IEICE Vol.J87-D-II, No.6, pp.1329--1338., 2004.6.

It has been recognized that existing methods for rating English texts by reading level are mostly aimed at native speakers of English and therefore are not completely appropriate for Japanese learners of the language. Here we propose a method for rating English texts by reading level specifically targeted at Japanese learners of the language. To rate the reading level of a text for a Japanese learner of English, our method takes two types information regarding a given text into account, namely, vocabulary and grammatical structure. Specifically, we rate the reading level of a text by using a vocabulary list and parser to extract particularly difficult vocabulary items or grammatical structures as features. To rate a text's reading level, two types of model are used:

multiple regression and neural networks. Our experiments show that the proposed methods rate the reading level of a text with the following levels of accuracy: an average of 75% accuracy for multiple regression and 81% when using neural networks.

Sensation and Illusion of Rotation Caused by a Coriolis Stimulus [in Japanese], Naoki ISU, Atsuo KAWAI, and Fumito MASUI: Equilibrium Res., Vol.63, No.3, pp.183-193, 2004.

The sensation of rotation derived from the semicircular canal system during a Coriolis stimulus, or cross-coupled rotation, was estimated by an approach from mechanics with giving some hypotheses and simplifications on the semicircular canal system. By solving an equation of motion of the endolymph during a Coriolis stimulus with a moderate time course, rotating angle of the endolymph was obtained, and the sensation of rotation derived from each semicircular canal was estimated. Then the sensation was integrated in the whole semicircular canal system which was considered to be composed of three orthogonal semicircular canals. The sensation of rotation derived from the semicircular canal system comes into conflict with those from the otolithic system and the somatosensory system. The conflict causes an illusion such that the head rotates vertically with keeping inclination at a constant tilt angle. The nauseogenic severity of motion sickness caused by a Coriolis stimulus is enhanced in accordance with the integrated angle of rotation perceived by the illusion.

Recognizing Article Errors in the Writing of Japanese Learners of English[in Japanese], Ryo NAGATA, Tatsuya IGUCHI, Kenta WAKIDERA, Fumito MASUI, and Atsuo KAWAI: IEICE Vol.J87-D-I, No.1, pp.60--68., 2004.1.

In this paper, the authors propose a method to recognize article errors often seen in English text written by Japanese learners of English. In this method, article errors are recognized based on the statistic extracted from an electronic corpus such as English-language newspapers. The authors' method is different from earlier methods in that there is no need to create a dictionary or rules for article error recognition. The results of experiments confirm that the performance of the authors' method is equivalent or superior to earlier methods.

Question Answering Method -- Answering to Questions based on Hudge Data Set -- [in Japanese], Jun'ichi FUKUMOTO* and Fumito MASUI: Information Processing Society of Japan Magazine, vol.45, No.6, pp.30--25., 2004.

Recognizing Article Errors based on the Three Head Words, Ryo NAGATA, Fumito MASUI, Atsuo KAWAI, and Naoki ISU: In Proceedings of the Cognition and Exploratory Learning in Digital Age(CELDA 2004), pp.165--172, 2004.

A Method for Distinguishing Mass and Count Nouns Based on Contextual Information, Ryo NAGATA, Fumito MASUI, Atsuo KAWAI, and Naoki ISU: In Proceedings of the 4th International Symposium

on Human and Artificial Intelligence Systems(International Series on Natural and Artificial Intelligence), pp.516--521, 2004.

MAIQA: Mie Univ. Participated System at NTCIR4 QAC2, Naoya HIDAKA and Fumito MASUI: In Working Notes of the Fourth NTCIR Workshop Meeting(NTCIR4), pp.315--319, 2004.

Question Answering Chlallenge for Information Access Dialogue -- Overview of NTCIR4 QAC2 Subtask3 --, Tsuneaki KATO*, Jun'ichi FUKUMOTO*, and Fumito MASUI: In Working Notes of the Fourth NTCIR Workshop Meeting(NTCIR4), pp.291--297, 2004.

Question Answering Callenge for Five ranked anwers and List answers -- Overview of NTCIR4 QAC2 Subtask 1 and 2 --, Jun'ichi FUKUMOTO*, Tsuneaki KATO*, and Fumito MASUI: In Working Notes of the Fourth NTCIR Workshop Meeting(NTCIR4), pp.283--290, 2004.

Handling Information Access Dialogue through QA Technologies - A novel challenge for open-domain question answering, Tsuneaki KATO*, Jun'ichi FUKUMOTO*, Fumito MASUI and Noriko KANDO*:
In Proceedings of the Workshop on Pragmatics of Question Answering at HLT-NAACL 2004, pp.70--77, 2004.

Assessment of Regional Intra-myocardial Layer Function from Ultrasonic RF echo Signal Using Hierarchical Correlation Method with Confidence, Kiyotsugu SEKIOKA*, Toshihiro KUMISADA, Shinji TSURUOKA, Hirotake ISHII, Wataru OHYAMA, and Tetsushi WAKABAYASHI: The Transactions of The Institute of Electronics, Information and Communication Engineers, Vol. J87-D-II, No.1, pp.98-108, January, 2004

Automatic text classification of English newswire articles based on statistical classification techniques, Guowei ZU, Wataru OHYAMA, Tetsushi WAKABAYASHI and Fumitaka KIMURA: The transactions of The Institute of Electrical Engineers of Japan: Vol.124-C, No.3,pp 852--860, March, 2004

Background removal for check processing using morphology, Yimei DING, Fumitaka KIMURA, Minoru OKADA*, Malayappan SHRIDHAR* and John W. V. Miller*: Two- and Three-Dimensional Vision Systems for Inspection, Control, and Metrology KK, edited by Kevin G. Harding, Proceedings of SPIE Vol.5606, pp.19-pp.26, Bellingham, WA, 2004

Automatic Tracking for Regional Myocardial Motion by Correlation Method with Connecting Multiple ROIS, Wataru Ohyama, Masaki Inami, Tetsushi Wakabayashi, Fumitaka Kimura, Shinji Tsuruoka, Kiyotsugu Sekioka*: IEEJ Trans. EIS, Vol.124, No.10, 2004

Eigenspace Method by Autoassociative Networks for Object Recognition, Takamasa Yokoi, Wataru Ohyama, Tetsushi Wakabayashi and Fumitaka Kimura: Structural, Syntactic, and Statistical Pattern Recognition (Joint IAPR International Workshops SSPR2004 and SPR2004 Proceedings), Springer LNCS 3138, pp.95-103, Lisbon, Purtugal, Aug. 18-20, 2004

Two Dimensional Motion Tracking of Left Ventricular Myocardium Using Ultrasonic Doppler Signal, Wataru Ohyama, Toshikazu Muramatsu, Tetsushi Wakabayashi, Fumitaka Kimura, Shinji Tsuruoka and Kiyotsugu Sekioka*: Proceedings of the Sixth IASTED International Conference on Signal and Image Processing, pp.436-440 (#444-187), Honolulu, Hawaii, USA, Aug. 23-25, 2004

Local Slant Estimation for Handwritten English Words, Yimei Ding, Wataru Ohyama, Fumitaka Kimura and Malayappan Shridhar*: Proceedings of the 9th International Workshop on Frontiers in Handwritten Recognition, pp.328-333, Kokubunji, Tokyo, Japan, Oct. 26-29, 2004

A Study on Decision Rule for Japanese Dictation Test, Meng Shi, Wataru Ohyama, Tetsushi Wakabayashi and Fumitaka Kimura: Proceedings of the 9th International Workshop on Frontiers in Handwritten Recognition, pp.592-596, Kokubunji, Tokyo, Japan, Oct. 26-29, 2004

The Impact of OCR Accuracy on Automatic Text Classification, Guowei Zu, Mayo Murata, Wataru Ohyama, Tetsushi Wakabayashi and Fumitaka Kimura: Proc. of AWCC2004, ZhenJiang, China, pp.403-409, Nov. 2004

Accuracy Improvement of Automatic Text Classification Based on Feature Transformation and Multi-classifier Combination, Xuexian Han, Guowei Zu, Wataru Ohyama, Tetsushi Wakabayashi and Fumitaka Kimura: Proc. of AWCC2004, ZhenJiang, China, pp.463-468, Nov. 2004

Department of Physics Engineering

*nonmember

Fluctuation Spectrum of Director in Cholesteric Phase with External Field, M. Yamashita: Mol. Cryst. Liq. Cryst. 409, pp. 219-227, 2004.

Fluctuation spectrum of molecular orientation in the cholesteric phase exposed to the external field with positive anisotropy is calculated for the general case of Frank's elastic constants. The stability of the phase is certified in the meaning of Peierls-Landau theory.

The Order and the Polarisation of the System Composed of Polar Gay-Berne Molecules with Bend, T. Miyazaki* and M. Yamashita: Mol. Cryst. Liq. Cryst. 413, pp. 117-124, 2004.

NVT molecular dynamics simulation is carried out to study the relation of molecular shape and dipole moment to the liquid crystalline ordering at the system of coupled Gay-Berne molecules which are dimers of two types of Gay-Berne particles coupled by harmonic spring at each end. The appearances of polarization and biaxiality together with the location of clearing temperature are reported for various types of combination of position and direction of the dipole attached to molecule.

Ordering in Chiral Smectics at Freely Suspended Film, M. Yamashita: Ferroelectrics 309, pp. 63-73, 2004.

The method to study phase transitions of thin systems on the basis of the bulk phase diagram is applied to a freely suspended film of ferroelectric smectics showing a first order phase transition in the bulk, where the ordering effect due to surface layers is replaced by an effective field which is conjugate to the order parameter. In the framework of a phenomenological free energy, whose coefficients are determined form the experimental evidence about C7, behaviours of transition are clarified, which coincides with experimental findings, and especially the small shift of transition temperature from the bulk one is elucidated. The continuous change occurring in the system of thickness just below a critical thickness is proved to be achieved by an insertion of an unstable state of the interior layers, which is never realised in the bulk. This mechanism of continuous change shows the difference between the ordering effects due to the boundaries and external fields.

Isotropic, Nematic and Smectic A Phase Behaviour in a Fictitious Filed, M. Torikai and M. Yamashita: J. Phys. Soc. Jpn., 73, pp. 2154-2157, 2004.

Phase behaviours of liquid crystals under external fields, conjugate to the nematic order and smectic order, are studied within the framework of mean field approximation developed by McMillan. It is found that phase diagrams, of temperature vs interaction parameter of smectic A order, show several topologically different types caused by the external fields. The influences of the field conjugate to the smectic A phase, which is fictitious field, are precisely discussed.

Nematic Ordering of a Liquid Crystalline Homeotropic Cell, M. Yasen, M. Torikai and M. Yamashita: J. Phys. Soc. Jpn., 73, pp. 2453-2457, 2004.

Nematic ordering in a very thin system under the homeotropic anchoring condition is studied in the framework of the Maier-Saupe model. Nonuniformity due to the boundary effect is described in terms of an effective field which is conjugate to the order parameter, and behaviour of the system is analysed by observing loci of the effective fields on the phase diagram of the bulk. A continuous change occurring at the system with thickness just smaller than a critical thickness is shown to be mediated by an unstable state; a metastable high-temperature phase changes to a metastable low-temperature one continuously via an unstable phase between them. This mechanism is an analogue of the phenomenon occurring in a freely suspended film of a certain chiral smectic material.

Critical behavior near the metal-insulator transition in the one-dimensional extended Hubbard model at quarter filling, Kazuhiro SANO, Yoshiaki Ono* : Phys. Rev. B70, pp.155102-1--155102-6, 2004.

We examine the critical behavior near the metal-insulator transition (MIT) in the one-dimensional extended Hubbard model with the on-site and the nearest-neighbor interactions U and V at quarter filling using a combined method of the numerical diagonalization and the renormalization group(RG). The Luttinger-liquid parameter (K_r) is calculated with the numerical diagonalization for finite size systems and is substituted into the RG equation as an initial condition to obtain K_r in the infinite size system. This approach also yields the charge gap in the insulating state near the MIT. The results agree very well with the available exact results for U=infinity even in the critical regime of the MIT where the characteristic energy becomes exponentially small and the usual finite size scaling is not applicable.

Antiferromagnetic Exchange Coupling in RE-TM Films, Akira Inagaki, Masaya Tsuneoka, Atsushi Ohshima, Tadashi Kobayashi, Yuji Fujiwara, Shigeru Shiomi and Tsutomu Shiratori*: J. Magn. Soc. Jpn., 28, pp.312-317, 2004.

This paper reports the magnetic and magneto-optical properties of antiferromagnetic exchange coupled (AFC) RE-TM double layered films prepared by sputter deposition. The sample structure is glass/underlayer Ru/Gd-Fe-Co/(E-layer Fe-Co)/AFC layer Ru/(E-layer Fe-Co)/Gd-Fe-Co/protectivelayer Ru. The exchange coupling energy J was found to depend on Ru thickness of the AFC layer. The first AFC peak was found at an AFC layer thickness of 3.0 Å. Next we inserted a thin Fe-Co layer called the E-layer, between the AFC layer and the magnetic layer to improve the J value. In AFC RE-TM double layered films, a complicated Kerr loop was observed when each magnetic layer was thin. Then we compared the calculated result with the experimental result to distinguish the ferromagnetic coupling from the AFC. Next we investigated thermal stability of J.

Wall Structure and Energy on DWDD, Atsushi Ohshima, Kentaro Kusano, Tadashi Kobayashi, Yuji Fujiwara, Shigeru Shiomi and Masahiko Kaneko*: Trans. Magn. Soc. Jpn., 4, pp.152-155, 2004.

Wall structure and energy have been simulated for the Domain Wall Displacement Detection

(DWDD), and the front process and the rear process under temperature gradient have been considered. For the front process, when the mark length is comparable with the domain wall width in the displacement (D) layer, the domain copied on the D-layer from the memory layer collapses. By making the D-layer thin, the minimum mark length for which the domain wall displacement occurs can be shortened. For the rear process, we confirmed that by inserting the control layer between the D-layer and the switching layer, the mark length with which the ghost signal is suppressed becomes longer. By making the anisotropy energy constant in the D-layer increase, improvement in the DWDD process is expected.

Noncollinear magnetism phenomena induced at surface domain walls and in vortex cores of magnetic quantum dots, A. J. FREEMAN*, Kohji NAKAMURA, Tomonori ITO : Journal of Magnetism and Magnetic Materials 272-276, pp. 1122-1127, 2004.

We report noncollinear magnetism phenomena by means of several recent examples: (a) enhancement of magnetocrystalline anisotropy in ferromagnetic (FM) Fe films by intra-atomic noncollinear magnetism, (b) noncollinear magnetic structures of domain walls in FM Fe and antiferromagnetic NiMn, and (c) curling spin and orbital structures in the vortex core of an Fe quantum dot, as obtained from the first principles full-potential linearized augmented plane wave method including noncollinear magnetism with no shape approximation for the magnetization. These results are in good agreement with experiments, and give new information about magnetic phenomena at surfaces and in nanostructures.

Noncollinear magnetism and enhancement of magnetocrystalline anisotropy at the Σ3(111) grain boundary in ferromagnetic Fe, Kohji NAKAMURA, Tomonoi ITO, A. J. Freeman*, L. Zhong*, J. F. Castro* : Applied Physics Letters 84 , pp. 4974-4976, 2004.

Magnetic structures and magnetocrystalline anisotropy of the Σ3(111) grain boundary (GB) in ferromagnetic Fe are investigated by the first-principles full-potential linearized augmented plane-wave method including intra-atomic noncollinear magnetism. In breaking the spatial translation symmetry in a crystalline solid, GB is found to give rise to a magnetic noncollinearity, where the magnetic moments at both sides of the GB orient at a angle about 10° with respect to each other. Importantly, the presence of the GB enhances the magnetocrystalline anisotropy energy by one order of magnitude from its bulk value and may induce a pinning effect on the magnetization rotation or magnetic domain wall motion.

Atomically sharp magnetic domain wall in thin films Fe(110): A first principles noncollinear magnetism study, Kohji NAKAMURA,, Yoshifumi TAKEDA, Toru AKIYAMA, Tomonori ITO, A. J. Freeman* : Physical Review Letters 93, pp.057202-1-4, 2004.

Magnetic domain wall structures in an Fe(110) monolayer are determined by the highly precise firt principles full-potential linearized augmented plane-wave method including intra-atomic noncollinear magnetism. The self-consistent results demonstrate that the magnetization changes from one orientation to the opposite (180°) orientation within 8 Å width without any abrupt rotation. This

narrow domain wall is found to arise from band effects. Our results are consistent with and support domain walls having a 6 Å width recently observed in spin-polarized scanning tunneling microscopy experiments.

Magnetic structures and out-of-plane magnetic anisotropy at the exchange bias interface: Co/FeMn, Kohji NAKAMURA, Tomonori ITO, A. J. Freeman* : Physical Review B 70, pp. 060404(R)-1-4, 2004.

The magnetic structures and anisotropy at the compensated ferromagnetic/antiferromagnetic Co/FeMn interface are investigated by the highly precise first principles full-potential linearized augmented plane-wave method that incorporates intra-atomic noncollinear magnetism in order to understand the magnetic complexity involved in the spin-flop coupling and the presence of intra-atomic noncollinear magnetism. The self-consistent results predict that the Fe moments in the FeMn layer reorient away from their directions in bulk FeMn so as to be parallel to the Co moment direction – a reorientation that induces an out-of-plane magnetic anisotropy. These results appear to support and confirm recent experimental x-ray magnetic circular dichroism findings that rule out spin-flop coupling as the mechanism for exchange bias in this system.

Modern computational magnetism: role of noncollinear magnetism in complex magnetic phenomena, A. J. FREEMAN* and Kohji NAKAMURA: Physica Status Solidi (b) 241, pp. 1399-1405, 2004.

Modern computational magnetism continues to grow at an accelerating pace stimulated by new and exciting discoveries important for basic science and technological applications. Here, we review some recent important progress made in treating complex noncollinear magnetic phenomena arising from the breaking of symmetry at surfaces, interfaces, and nanostructures, by means of our newly generalized first principles full-potential linearized augmented plane wave (FLAPW) method for noncollinear magnetism with no shape approximation to the magnetization. Because of space limitations, we restrict our report illustrate results of the noncollinear magnetic structures induced at the FM NiFe/AFM NiMn interfaces, in the domain walls of FM Fe and AFM NiMn, and in the vortex cores of a Fe quantum dot. These results are in good agreement with experiments and give new information about magnetic phenomena at surface, interfaces, and in nanostructures.

Systematic theoretical investigations of adsorption behavior on the GaAs(001)-c(4x4) surfaces, Tomonori ITO, Kazumi TSUTSUMIDA, Kohji NAKAMURA, Yoshihiro KANGAWA*, Kenji SHITRAISHI*, Akihito TAGUCHI*, Hiroyuki KAGESHIMA* : Applied Surface Science 237, pp. 194-199, 2004.

Adsorption behavior on the GaAs(001)-c(4x4) surfaces is systematically investigated by using our ab initio-based approach and the Monte Carlo methods. The change in stable structure of the c(4x4) surfaces is clarified by considering adsorption or desorption of surface dimers as functions of temperature and As pressure. The calculated results imply that the c(4x4) surface with As dimers is stable at low temperatures less than ~400 K, whereas the surface with Ga-As dimers is stabilized at high temperatures in the range of ~400 K to ~700 K. The disordered dimer arrangements consisting of Ga and As substituted by each other in the c(4x4) unit cell hardly appear even at high temperatures

such as ~800 K. We also investigate the behavior of Ga and As adatoms on these c(4x4) surfaces. The calculated results reveal that Ga atoms can adsorb and migrate on the surfaces while desorption of As adatoms proceeds without sufficient migration.

Theoretical investigations of adatom behavior on non-planar surfaces with GaAs(*n*11)A, Koichi ASANO, Yoshihiro KANGAWA*, Hirotoshi ISHIZAKI, Toru AKIYAMA, Kohji NAKAMURA, Tomonori ITO : Applied Surface Science 237, pp. 206-212, 2004.

The behavior of Ga and As adatoms on non-planar surfaces consisting of GaAs(001)-(2x4) and GaAs(*n*11)A (*n*=2, 3 and 4) surfaces are investigated by empirical interatomic potentials with the aid of ab initio calculations. The calculated results imply that Ga adsorption energies strongly depend on the surface orientation, whereas As adsorption energies keep almost constant. The difference in adsorption energies can be interpreted by considering strain energy. In particular, Ga adatom is stabilized on the (311)A surface by the smallest strain energy forming interatomic bonds with three As atoms located at the regular fcc sublattice. Furthermore, we roughly simulate resultant surface profile of GaAs thin films on the non-planar surfaces consisting of the (001)-(2x4) top and (*n*11)A side surfaces based on the rate equation. The simulated results reveal that the non-planar surface with (311)A side surface forms the linear surface profile.

First-principles analyses of O_2 molecules around ultrathin SiO_2/Si(100) interface, Toru AKIYAMA, Hiroyuki KAGESHIMA*, Tomonori ITO : Japanese Journal of Applied Physics 43, pp. 7903-7908, 2004.

The microscopic structures and reaction mechanisms of O_2 molecules at ultrathin SiO_2/Si(100) interface are investigated based on first-principles total-energy calculations. It is found that the molecular-type oxygen is stable in the SiO_2 region of the interface, while the O_2 in the Si substrate dissociates and two Si-O-Si bonds are formed. It is also found that the O_2 in the SiO_2 region can directly react with the Si substrate. The energy barrier for its reaction (0.2 eV) does not correspond to (previously consented) serving process of interfacial Si-Si bonds, but to the formation of weak Si-O bonds between the O atoms of oxidant and the interfacial Si atoms: The hybridization of the oxygen-2p orbitals of the oxidant and the valence band states of the Si substrate is the principal factor of the reaction. The calculated results imply that other microscopic mechanisms such as accumulation of interfacial strain or its release mechanisms are involved in the interfacial reaction during Si oxidation.

Theoretical study of excess Si emitted from Si-oxide/Si interface, Hiroyuki KAGESHIMA*, Masashi UEMATSU*, Kazuto AKAGI*, Shinji TSUNEYUKI*, Toru AKIYAMA, Kenji SHIRAISHI* : Japanese Journal of Applied Physics 43, pp. 8223-8226, 2004.

The excess Si emitted from the Si-oxide/Si interface is studied using the first-principles calculations. It is shown that the excess Si can have many (meta-) stable positions around the interface. In addition, some positions in the oxide do not have any dangling bonds or floating bonds in contrast to those in the bulk crystalline Si. The results indicate that the emitted Si can be located in the oxide layer

but they do not necessarily cause charge traps in the oxide. The emitted Si atoms are thought to just be oxidized and absorbed into the oxide while a portion of them cause the E' centers, the P_b centers or charge traps.

Thermodynamic stability for group IV alloy semiconductors [in Japanese]. Tomonori ITO, Yoshihiro KANGAWA* : Journal of the Japanese Association for Crystal Growth 31, pp. 4-11, 2004.

Thermodynamic stability of group IV alloy semiconductors such as $Si_{1-x-y}Ge_xC_y$ solid solutions in bulk and thin film states is systematically investigated by excess energy calculations based on empirical interatomic potentials and Monte Carlo (MC) simulations. In bulk state, the calculated excess energies for $Si_{1-x-y}Ge_xC_y$ have positive values over the entire concentration range. This implies that $Si_{1-x-y}Ge_xC_y$ with a random distribution of Si, Ge and C is thermodynamically unstable at 0 K. Furthermore, the excess energies of $Si_{1-x-y}Ge_xC_y$ increase with Ge content x when C content y remains constant. This is because an increase of Ge content introduces large strain energy in $Si_{1-x-y}Ge_xC_y$. In thin film state, although lattice constraint at the interface reduces the excess energies by 20-30 % of those in bulk state, we obtain similar results to those in bulk state. Further MC simulation reveal that Ge atoms segregate in the topmost layer and C atoms accumulate in the second layer.

Plastic Deformations of Micro-Spheres by Solidified Lubricants and Lubricants' Shear Characteristics under Very High Pressure (Part 1) — Observation of Plastically-Deformed Micro-Spheres — [in Japanese], Yuichi NAKAMURA, Yutaka ISHIBASHI* and Yasushi KUROSAKI: Tribologist, 49-6, pp. 518-524, 2004.

Fractal analysis of adhesion on tool surface in compression of aluminum strips by using AFM [in Japanese], Masahito MATSUI, Yasushi KUROSAKI and Yusuke MIYAUCHI: Journal of Japan Institute of Light Metals, 54-1, pp. 9-13, 2004.

Adhesion properties in simple compression of aluminum strips are analyzed in the micro/nanometer range by employing the zeroset and power spectrum fractal analyses. An atomic force microscope (AFM) is used to estimate the fractal dimensions. It is found that the adhesion and tool and specimen surfaces have fractal structure. Various fractal dimensions obtained for the adhesion and tool and specimen surfaces are compared to each other and discussed. When the surface roughness of tool is same, the ratio of the total adhesion area depends on the fractal dimension. Though the AFM apparatus is difficult to distinguish the adhesion particles from the tool surface, the power spectrum dimension has possibility of distinguishing the adhesion particles from the tool surface. Finally, a method for computer simulation of the nanometer scale surface structure is presented, and satisfactory images are constructed.

Nanofractal Analysis on Material Surfaces Using AFM, Mir Behdad Khamesee, Yasushi Kurosaki, Masahito Matsui and Kenichi Murai: Materials Transactions, 45-2, pp. 469-478, 2004.

The surface structures of four materials (a pure aluminum sheet, an aluminum alloy sash, a

thickness gauge and a magnetic tape) are observed on the nanometer scale by atomic force microscopy (AFM) and analyzed by one-dimensional fractal analyses. It is confirmed for all the surfaces that they have a self-affined fractal property under a resolution of 1nm. The two-dimensional fast Fourier transformation (2D-FFT) analysis is also applied to these surfaces and their characteristics are clarified. The power spectrum model for surface simulation is proposed and its validity is confirmed by experimental results. A method for simulating surface structure of any materials is presented, and its validity is shown on some materials whether in-plane isotropic or anisotropic. A computer aided engineering (CAE) system composed of 2D-FFT and inverse FFT (IFFT) for quantitative estimation of surface nanostructures is advanced and applied to various surface problems. It enables the mass data of material surface to compress into only three parameters.