

ABSTRACTS OF PUBLISHED PAPERS

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CONDENSED MATTER AND MATERIAL

Fabrication and Photoluminescence of AlGaAs/ GaAs Quantum Wire Superlattices on V-grooved Substrate

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SUPERLATTICES AND MICROSTRUCTURES

22 2 (1997) 221-227

An AlGaAs(90Å)/GaAs(45Å) quantum wire superlattice (QWR-SL) with excellent size uniformity is grown on a 4.8 μm pitch V-grooved substrate by flow rate modulation epitaxy at a specific growth temperature (~630°C). In the low temperature (12K) photoluminescence spectrum of the AlGaAs(90Å)/GaAs(45Å) QWR-SL, two excited subband emission peaks are observed at an excitation power density at least about 4 orders of magnitude lower than that needed for the observation of similar peaks from the single quantum wire (SQWR) reference sample. Another two side-peaks are also observed at the long wavelength side of the ground subband peak whose energy separations from the excited subband peaks are very close to the energies of GaAs optical phonons, implying the possibility of participation of optical phonons in the radiative transition processes of the QWR-SL. The ground subband emission peak of the QWR-SL sample shows a radiative lifetime (~2.1ns) almost 4 times longer than that of the SQWR sample. The above observations suggest that the carrier relaxation processes and the radiative transition probability of the QWR-SL seem to be considerably modified against the SQWR structure.

A High Gravity Chemical Vapor Deposition Apparatus

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Review of Scientific Instruments **68** 11(1997) 4225-4231

A high gravity centrifuge facility in which thin films can be produced, especially from gas phase, was developed. The centrifuge facility allows high gravity materials processing up to 100g (*g* denotes the terrestrial gravity acceleration). With a minor modification, not only thin films from gas phase but also bulk materials could be produced in the facility. For the first demonstrative attempt in this facility, diamond thin films were grown under high gravity conditions up to 100g by means of the direct current-plasma chemical vapor deposition method, in which diamond was deposited on a molybdenum substrate in a moderate pressure condition (27 kPa) of the gas flow of hydrogen-methane mixture (methane 1 vol%). The details of the facility are described, and the preliminary results on the high gravity diamond synthesis are presented.

Positron 2D-ACAR Calculations on Organic Conductors

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and ¹Ludger HOFFMANN

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Materials Science Forum **225-257** (1997) 194-198

Positron two-dimensional angular correlation of annihilation radiation (2D-ACAR) spectra have been simulated on several organic conductors by a method in which electronic wave functions are expressed in terms of molecular

orbitals of constituent molecules. The theoretical predictions are in rather good agreement with the experimental results, and are expected to help interpret the data.

Calculation of Positron 2D-ACAR Spectra on C₆₀

Shoji ISHIBASHI

Materials Science Forum **255-257** (1997) 542-544

Positron 1D- and 2D-ACAR spectra have been calculated on the C₆₀ crystal with the LDA as well as the GGA utilizing the results of self-consistent molecular orbital calculations. The resultant 1D-ACAR spectra have been compared with the existing experiments. Anisotropies of 2D-ACAR on the low temperature structure are predicted.

Experimental and Theoretical Exploration of Photodissociation of SO₂ via the \tilde{C}^1B_2 State: Identification of the Dissociation Pathway

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J.Mol.Struct. **413-414** (1997) 589-614

The photodissociation reaction of SO₂ via the \tilde{C}^1B_2 state, was investigated by experimental and theoretical approaches cooperatively to clarify its dissociation mechanism. It was found that the dissociation rates increases almost exponentially as an excess energy above the dissociation threshold though there is a certain fluctuation of the dissociation rates reflecting a mode specificity. We also performed theoretical ab initio calculations to derive potential energy surfaces of the electronic ground and excited states. We propose that the photodissociation reaction via the \tilde{C} state proceeds mainly through the vibronic mixing between the \tilde{C} state vibronic levels with the quasi-bound dissociation continuum of the electronic ground state.

Experimental Model and Long-term Prediction of Photovoltaic Conversion Efficiency of a-Si Solar Cells

Kiyoshi TAKAHISA, Takeshi KOJIMA,
Kuniomi NAKAMURA, Tadamasu KOYANAGI
and Takesi YANAGISAWA
SOLAR ENERGY MATERIALS AND SOLAR CELLS
49 (1997) 79-186

Degradation and recovery tests have been conducted on recent single-junction a-Si solar cells under various light intensities and temperature conditions to predict long-term stability. Saturation phenomena of the degradation of efficiency have been shown experimentally. The degradation characteristics are expressed as the second extreme distribution function of the largest value with saturation introduced. The dependence of saturation on the cell temperature and the light intensity are investigated. The worst efficiency of seasonal changes over a long term can be predicted from the saturation characteristics.

Evidence for Exciton Localization in V-shaped Quantum Wires

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PHYS. STAT. SOL. (A) **164** (1997) 273-276

Crescent-shaped AlGaAs/GaAs quantum wires have been investigated using microscopic photoluminescence and photoluminescence excitation spectroscopy. The main photoluminescence line is split into sharp peaks of width less than 0.5 meV and separated by a few meV. They are attributed to exciton localized states in one monolayer deep quantum boxes present at the (001) top facet of the wire and larger than the exciton Bohr radius. Microphotoluminescence excitation reveals also a fine structure of the first excitonic transition formed by sharp peaks each one corresponding to sections of the wire with slightly different confining potentials.

ELECTRONIC DEVICES

Stability of Cu(In,Ga)Se₂ Solar Cells and Evaluation by C-V Characteristics

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Solar Energy Materials and Solar Cells **50** (1998) 87-95

To confirm the long-term reliability of Cu(In,Ga)Se₂ (CIGS) solar cells, we investigated the *I-V* and *C-V* characteristics during tests under irradiation or dark condition. Under irradiation, the test samples showed a little increasing efficiency (η) and open-circuit voltage (V_{oc}), that showed their electrical durability to light irradiation. But the diode factor (n) and series resistance (R_s) showed larger change of their values. Also the built-in voltage (V_b) and density gradient (dN_A/dx) in the CIGS layer calculated from the *C-V* characteristics showed distinct change during the test. After 4 SUN irradiation, two samples in a same fabrication lot showed new light absorption in the lower-energy range than the energy gap of CIGS. We explained the change of *C-V* characteristics for the samples under strong irradiation with a new model named "Junction retrograde" which can treat the defects generation by irradiation to reduce the acceptor density in graded p-n junction. This model for *C-V* analysis can be used to investigate the long term reliability of CIGS solar cells under irradiation.

Measuring System for Solar Cell

Naomasa YUI and Toshihiro SEKIGAWA

*THE TRANSACTIONS OF THE INSTITUTE OF
ELECTRONICS, INFORMATION AND
COMMUNICATION ENGINEERS C-II*

J81-C-II 1 (1998)207-212

The diffused reflectance measuring system based on a new principle was developed to examine optical trapping effect of a solar cell in detail. Then, the performance evaluation of the system was done. It was confirmed that the measurement of the distribution and the integrated value could be carried out easily as a result.

Dairy Information Assistance with Personal Interface Agents

Ichiro OSAWA

Proceedings of WISS'97 (1997) 175-180

A new computational model of daily information assistance with personal interface agents is presented to achieve human-centered interaction between people and software agents in everyday life. The brains of personal interface agents are located apart from the owners. The agents have their own Internet addresses (URL), and the owners interact with their agents via Internet. A software agent on a street also obtains the URL of a personal interface agent when the software agent meets the owner on the street. Then the software agent starts to interact with the personal interface agent using the URL, and they exchange the information of the interaction between the owner and the software agent. As a result, personal interface agents always observe the interaction of the owners with software agents, and help the owners when they are in trouble.

An Extension of the Back-propagation Algorithm to Complex Numbers

Tohru NITTA

Neural Networks **10** 8 (1997) 1391-1415

This paper presents a complex-valued version of the back-propagation algorithm (called 'Complex-BP'), which can be applied to multi-layered neural networks whose weights, threshold values, input and output signals are all complex numbers. Some inherent properties of this new algorithm are studied. The results may be summarized as follows. The updating rule of the Complex-BP is such that the probability for a "standstill in learning" is reduced. The average convergence speed is superior to that of the real-valued back-propagation, whereas the generalization performance remains unchanged. In addition, the number of weights and thresholds needed is only about the half of real-valued back-propagation. The Complex-BP can transform geometric figures, e.g., rotation, similarity transformation, and parallel displacement of straight lines, circles, etc., whereas the real-valued back-propagation cannot. Mathematical analysis indicates that a

Complex-BP network which has learned a transformation, has the ability to generalize that transformation with an error which is represented by the sine. It is interesting that the above characteristics appear only by extending neural networks to complex numbers.

Organizing Phone Models Based on Piecewise Linear Segment Lattices of Speech Samples

Hiroaki KOJIMA and Kazuyo TANAKA
Proc. EuroSpeech' 97 (1997) 1219-1222

Aiming at robust speech recognition, we have proposed a framework for "*phonological concept formation*," which is the task of acquiring an efficient representation of phonemes from spoken word samples without using any transcriptions except for the lexical classification of the words. In order to implement this task, we propose the "*piecewise linearsegment lattice (PLSL)*" model for phoneme representation. The structure of this model is a lattice of segments, each of which is represented as regression coefficients of feature vectors within the segment. In order to organize phone models, operations including division, concatenation, blocking and clustering are applied to the models. Feasibility of the method is discussed with experimental results for isolated word recognition. The recognition rate is improved by applying these operations.

User-friendly Interface of Service Robot: Knowledge Projection on Robot Task Environment

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Proceedings of the International Conference on Field and Service Robotics '97 (1997) 145-150

Service robots that coexist with humans must function safely and smoothly. The systems must exchange task information with people via adequate interfaces. We propose a "Projection Function" as the interface for information exchange and discuss a delivery by hand as an important example. The paper also reports on an experimental system we have designed and constructed.

Speech Enhancement Using Array Processing Based on the Coherent-subspace Method

Futosh ASANO and Satoru HAYAMIZU
IEICE Trans. on Fundamentals. E80-A 11 (1997) 2276-2285

A method for recovering the LPC spectrum from a microphone array input signal corrupted by less directional ambient noise is proposed. This method is based on the subspace method, in which directional signal and non-directional noise is classified in the subspace domain using eigenvalue analysis of the spatial correlation matrix. In this paper, the coherent subspace (CSS) method, a broadband extension of the subspace method, is employed. The advantage of this method is that it requires a much smaller number of averages in the time domain for estimating subspace, suitable feature for frame processing such as speech recognition. To enhance the performance of noise reduction, elimination of noise-dominant subspace using projection is further proposed, which is effective when the SNR is low and classification of noise and signals using eigenvalue analysis is difficult.

BIOSCIENCE

Effects of Pleasantness/Unpleasantness on the Event-Related Potentials Elicited by Mismatch between an Odorant Stimulus and a Word Stimulus.

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Chemical Senses 22 6 (1997) 809*

ERPs were recorded while 14 students judged the veracity of a simple statement (e.g., Lemon/is/pleasant) presented with the order of subject(S), object(O), and verb(V), which is normal in Japanese grammar with S-O-V paradigm. An odor was given as subject(S) and a word of pleasantness/unpleasantness was used as object(O). The students judged the statement's truth or falsity by pushing button. In both conditions, a late negative potential was elicited by the object(O) stimulus when it was mismatch with subject(S) in the condition which the unpleasant odor was given. In

addition, the negativities elicited by the incongruous odorant stimulus and word or the emotion had the same morphology and scalp distribution. These results indicate that not only a word but a physical stimulus such as an odor or the emotion of pleasantness/unpleasantness which deviates from a semantic context or the emotion can also elicit the negative potentials as same N400 component as a color patch already by J.Katayama and A.Yagi.

Ipsi-Lateral Dominance of Human Olfactory Active Centers Estimated from the Event-Related Magnetic Fields Measured by 122-Channel Whole-Head Neuromagnetometer Using Odorant Stimuli Synchronized with Respirations.

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Chemical Senses **22** 6 (1997) 809

Olfactory event-related magnetic fields were measured by the blast method which was controlled under the synchronization with subject's respirations. The generators of olfactory magnetic fields were estimated at two regions located fairly non-symmetrically near the bilateral frontal areas. In almost all subjects the latency and intensity of ipsilateral olfactory MEG responses were the shorter and the larger than that of the contra-lateral olfactory MEG responses, respectively. These results suggest that the olfactory MEG responses on ipsi-lateral side are generally larger and dominant than that on the contra-lateral side in the human olfactory system.

OPTICS AND RADIATION

Comparison between Electron Yield, PSD Ion Yield, and Surface PIPICO Yield in Near C and O K-Edge XAFS in Condensed Methyl Formate-D

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J. Phys. IV (Paris) **7** (1997) C2-505-C2-506

We have studied the near edge X-ray absorption fine structure of photon stimulated desorption (PSD-NEXAFS) of positive ions from condensed layer of methyl formate-d (DCOOCH₃) in the C K-edge (280-310 eV) and O K-edge (520-560 eV). Ion yields of H⁺, D⁺, CH_n⁺, O⁺, and OCH_n⁺, (n=0-3) can be concurrently taken as a function of photon energy, using a time-of-flight (TOF) spectroscopy with pulsed synchrotron radiation. We find that fragment ion yields show particular enhancement of the core resonance corresponding to certain antibonding states, compared with the photoabsorption cross section curve. We utilize a photoion photoion coincidence (PIPICO) technique for investigating the PSD pathways. The results give a good correlation between PIPICO yields and ion yields in the resonance. We conclude that the fragmentation pathway includes the formation step of multiple-charged precursor after the core resonant excitation even near edges, and that highly energetic fragments decomposed from such a precursor survive quenching or reneutralization by the surface and can desorb as ions.

ENERGY TECHNOLOGY

Residual Stress Analysis of Cylindrical Solid Oxide Fuel Cells

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and Yasuhiro KASUGA

Journal of the Ceramic Society of Japan

105 12 (1997) 1057-1061

The dependence of the residual stress in cylindrical solid oxide fuel cells (SOFCs) on the structures and the process temperatures was estimated using the analytical modeling of an axisymmetric structure. From the results of the analysis the following points were discovered. In the case of a 4-layered structure, which is supported by a porous insulation tube of calcia-stabilized zirconia (CSZ), the circumferential and axial stresses induced in the electrodes are so high that they can break the structure under the assumed realistic conditions. A method for reducing these stresses is discussed.

On the other hand, in the case of a 3-layered structure which is supported by an inner electrode tube, tensile stresses in the electrodes can be reduced to several MPa if the total thickness of two electrodes is more than 60 times the thickness of the electrolyte. New material for the substrate tube is proposed on the basis of the obtained results.

ENVIRONMENT TECHNOLOGY

Realization of an Accelerator for Environmental Refreshment in Case of Soil.

Hideaki ISOGAI

Proceedings of JSES /JWEA Joint Conference (1997)

This report describes to showed effective accelerating and measuring results of revitalized to environment especially in soil. Physical indices were weight and sweetness of object monitor fruits as our last time report. This acceleration used to catalysts of photosynthesis as primeval bacteria. In this time, apply to object fruits which were glowaps and takes from 3 kinds of conditions in soil. That confirmed to effectiveness of this accelerator and its environmental refreshment.

SPACE AND OCEAN TECHNOLOGY

An Analysis on Total Offset Pressure of Spinning Rotor Gauge.

Hideaki ISOGAI

Trans. IEE of Japan **117-A** 12 (1997) 1177-1181

This paper describes to analyze on total offset pressure from which caused to eddy current and thermal expansion in a spinning rotor. Although, these offset pressure damp to spinning to caused from vertical magnetic field and from self thermal expansion, mainly estimated to totally amount of eddy current's effect which was decided by distribution of all part of the magnetic flux density of a spinning rotor. Then, it was calculated to distribution of magnetic flux density in a rotor by a finite element method which used to an application software. It was result in constant amount and parallel to vertical magnetic field. Then, eddy current of the rotor will estimated to zero that caused to same amount and to collect from all directions with symmetrically. It is important that to keep the high accuracy within zero-total offset

pressure as constructed from symmetrical spinning condition and to protect incline the vertical spinning axis.

Simultaneous Control Experiment of Orientation and Arm Position of Space Robot Using Drop Shaft

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Journal of the Japan Society for Aeronautical and Space Sciences **45** 527 (1997) 705-712

We demonstrate the motion of a space robot in microgravity with the use of the drop shaft at the Japan Microgravity Center (JAMIC). The drop shaft provides 10 seconds of nongravity. The technique used to stably levitate a robot is the most important element in experiments with robot motions using a drop shaft. Therefore, we developed a holding mechanism with grippers and tested it first. We then proposed a sensor-based path planning method to control the orientation and arm position of a space robot. This method compiles a database of current sensory outputs, motion and next sensory outputs, and then searches the path using breadth-first search. This method is an application of a finite state machine. We proved the above results with experiments using a drop shaft.

