International Conference on Martensitic Transformations, Lausanne, Switzerland, 20-25, August, 1995

Stress Induced Martensitic Transformation from BCC to FCC in Ag-Zn Alloys

K. TAKEZAWA, R. AKAMATSU, and K. MARUKAWA
Department of Applied Physics, Faculty of Engineering,
Hokkaido University, Sapporo 060, Japan

The 9R martensite is stress-induced from the ordered bcc phase in Cu-Zn-Al and Cu-Al-Ni alloys. The martensite further transforms to the 3R martensite. The condition for this successive transformation has been clarified in a previous paper. In the present paper, the possibility of the transformation to the 3R structure in Ag-Zn alloy were investigated. It has been found that a disordered 3R martensite is formed by up-quenching from the room temperature to an above temperature. On the other hand, ordered 3R martensites are induced directly at room temperature by stressing. It has been also found that a 9R martensite appears at lower temperatures by cooling. To answer the question why these varieties happens, thermodynamical estimations were performed. The important role of the long range order in the alloy structure to determine the condition has been clarified.

International Conference on Martensitic Transformations, Lausanne, Switzerland, 20-25, August, 1995

The Mechanism of Rubber-like Behavior in Cu-Zn-Al Martensite

K. TSUCHIYA, K. TATEYAMA, and K. MARUKAWA
Department of Applied Physics, Faculty of Engineering,
Hokkaido University, Sapporo 060, Japan

In order to clarify the origin of the so-called rubber effect, the effects of room temperature aging on the stress strain curve in Cu-Zn-Al martensites have been investigated. Flow stress and the amount of recovered strain on unloading increased with aging. The effects of quenching procedure have also been examined. The results suggested that diffusion controlled atomic rearrangements in the martensite are responsible for the rubber effect. A model has been developed to explain the origin of the restoring force for the rubber-like behavior. It has been assumed that the short range ordered structure (SRO) is modified during aging. The variant alteration by straining disturbs the once developed SRO structure and results in a state with higher free energy. This leads to the driving force for the restoration of original variant

configuration upon unloading. A thoretical calculation based on this model using the cluster variation method has been found to give consistent values for the restoring force.

International Conference on Martensitic Transformations, Lausanne, Switzerland, 20-25, August, 1995

Short Range Ordering and Stabilization of the Martensite Phase in Copper Alloys

K. MARUKAWA, K. TSUCHIYA, and Y. ARAI
Department of Applied Physics, Faculty of Engineering,
Hokkaido University, Sapporo 060, Japan

The stabilization of a martensite phase, induced by room-temperature aging, results in a rise of the transformation temperature, so that it is annoying in the application of the shape memory effect. The origin of this effect has not been clarified yet. The characteristic temperatures of the martensitic transformation were measured by means of electrical resistivity. The rise of the reverse transformation temperature was obtained as a function of aging time. It has been found that the time constant of the development of the stabilization is relatively small. It is much smaller than that of the change in the long range order, which has been measured previously. On the basis of this and other experimental results, the cause of the stabilization has been attributed as the change in short range order in martensite crystals. The short range order has been calculated theoretically by the cluster variation method. The estimated value has been found to agree reasonably well with the experimental one.

Third Pacific Rim Conference on Recent Developments on Binary Star Research, Chiang Mai, Thailand, October 26-November 1, 1995

Speckle Data Analysis of Binary Stars with Neural Network

Naoshi BABA, Akifumi KISHINO, Noriaki MIURA, and Syuzo ISOBE

The application of an artificial neural network to speckle data analysis of binary stars is proposed. It is shown that the angular separation and the position angle are well estimated with the neural networks. Several simulation results are presented.

Third Pacific Rim Conference on Recent Developments on Binary Star Research, Chiang Mai, Thailand, October 26-November 1, 1995

Speckle Spectroscopic Observations of Be Binary Stars

Naoshi BABA, Susumu KUWAMURA, Yuji NORIMOTO, and Salvador CUEVAS

Several Be binary stars have been observed with speckle spectroscopic camera. Each spectrum of the primary and the secondary stars is spatially separated by the speckle spectroscopic method. The spectra around Hα line are examined.

East Asian Meeting on Astronomy, Tokyo, July 17-21, 1995

Two Colar Speckle Imaging

Naoshi BABA, Susumu KUWAMURA, Noriaki MIURA, and Yuji NORIMOTO

It is shown that high-resolution imaging is possible by reference to specklegrams observed at a widely separated wavelength. Specklegrams of Vega at $\lambda = 400$ nm and 800nm were simultaneously observed by using a 188cm telescope at the Okayama Astrophysical Observatory. Shift-and-add imaging at one wavelength results in a high-resolution peak, not diffraction-limited but better than seeing-limited, at the other wavelength.

International Topical Meeting on Optical Computing, April 21-25, 1996, Sendai, Japan

Nonlinear Optical Computing by Use of Partially Coherent System

Kazuhiko OKA, Sachiko KAWADA*, and Yoshihiro OHTSUKA
Faculty of Engineering, Hokkaido University, Sapporo, Japan
*Technical Laboratory, Citizen Watch Co., Ltd., Tokorozawa, Japan

A novel method for two-dimensional nonlinear optical computing is presented. Incorporation of a liquid crystal spatial phase modulator constructs a partially coherent optical system

which performs nonlinear optical computing.

International Conference on Optical Fiber Sensors, May 21-24, 1996, Sapporo, Japan

A new type of birefringent fiber fabricated for sensor use [I] —— Characteristics of tension-induced modal birefringence ——

S. TANAKA, K. YOSHIDA*, and Y. OHTSUKA
Department of Engineering Science, Faculty of Engineering,
Hokkaido University, Sapporo 060, Japan
*Yokohama R & D Laboratories, The Furukawa Electric Co., Ltd.
2-4-3 Okano, Nishi-ku, Yokohama 220, Japan

In most polarimetric sensors utilizing birefringent fibers, the phase retardation between the HE_{11}^{x} and HE_{11}^{y} orthogonal guided eigen modes has been conveniently available for sensing some measurands. The sensitivity of such sensors depends on beat length as well as on tension-induced birefringence. Tension-induced birefringence is governed by a cross-sectional, constitutional structure of fiber. For the design and fabrication for sensor use, it is particularly important to investigate how tension-induced modal birefringence is dependent on such a cross-sectional structure of fiber. We have developed a new type of birefringent fiber for sensor use that has two through-holes at both sides of core. This is called side-hole fiber. From the view point of sensor use, this paper presents some characteristics of the sampled fibers with respect to tension-induced modal birefringence.

International Conference on Optical Fiber Sensors, May 21-24, 1996, Sapporo, Japan

A new type of birefringent fiber fabricated for sensor use [II] —— Fiber parameters dependent on mechanical deformations ——

S. KINUGASA, K. YOSHIDA*, S. TANAKA and Y. OHTSUKA
Department of Engineering Science, Faculty of Engineering,
Hokkaido University, Sapporo, 060 Japan
*Yokohama R & D Laboratories, The Furukawa Electric Co., Ltd.
2-4-3 Okano, Nishi-ku, Yokohama 220, Japan

The most important factors for sensor use of birefringent side-hole fiber has been presented in a previous paper [I]. In this paper beat-length, mode-coupling coefficient, propagation loss, and retardation sensitivity for stretching and twisting are measured from the view point

of sensor use about five sampled, side-hole birefringent fibers.

International Conference on Optical Fiber Sensors, May 21-24, 1996, Sapporo, Japan

Quasi-distributed fiber-optic sensor based on spectral polarimetry

S. TANAKA, N. HASEGAWA, and Y. OHTSUKA
Department of Engineering Science, Faculty of Engineering,
Hokkaido University, Sapporo 060, Japan

This paper presents a fiber-optic quasi-distributed sensor for measurements of the multiple locations along a length of birefringent fiber to which lateral concentrating forces are applied. A broadband spectrum, modified with interference by a normal guided mode with the other cross-coupled modes, provides significant information about the cross-coupled locations resulting from the forces. The interference modification factor can be extracted from the modified spectrum, and its Fourier transform gives knowledge about the cross coupled locations.

International Conference on Optical Fiber Sensors, May 21-24, 1996, Sapporo, Japan

Fiber-optic high sensitive magnetostrictive sensor immune from external disturbances

M. MURAKAWA, S. TANAKA, and Y. OHTSUKA
Department of Engineering Science, Faculty of Engineering,
Hokkaido University, Sapporo 060, Japan

In general, fiber-optic interferometric sensors are likely to suffer from environmental disturbances such as vibration and temperature fluctuations. For practical use, it is invoked to eliminate or cancel such external disturbances. To this end, we have devised a novel fiber-optic magnetostrictive sensor made up of a specially designed double Mach-Zehnder interferometer using polarization maintaining single-mode fibers (PMSF). This fiber-optic interferometer operating in an optical heterodyne detection mode is capable of canceling the external disturbances. This paper presents its high-sensitive performance and immunity from temperature disturbances.

International Symposium on Polarization Analysis and Applications to Device Technology, June 12-14, 1996, Yokohama, Japan

Optical Heterodyne Polarimeter with Spatiotemporal Carrier Frequencies for Studying Dynamic Photoelastic Stresses

Kazuhiko OKA and Yoshihiro OHTSUKA
Faculty of Engineering, Hokkaido University, Sapporo, Japan

An optical heterodyne polarimeter operating with spatiotemporal carrier frequencies is presented for contour mapping of dynamic principal stress distributions in an epoxy photoelastic sample. Introducing of the spatiotemporal carrier frequencies causes the temporal and spatial resolutions to be fairly improved in the mapping of the stress distributions.

International Symposium on Polarization Analysis and Applications to Device Technology, June 12-14, 1996, Yokohama, Japan

Retardation Measurements of Light Scattered by Metallic Rough Surfaces

Naoki NAGASHIMA, Yasushi SAWADA, Norimichi SHIBUYA,
Kazuhiko OKA, and Yoshihiro OHTSUKA
Faculty of Engineering, Hokkaido University, Sapporo, Japan

An optical heterodyne polarimetric interferometer with an orthogonal linearly polarized two-frequency laser beam is used for measurements of phase retardations of light scattered by metallic rough surfaces. A change in retardation is dependent on the incident and scattering angles, and measured for the copper and aluminum rough surfaces. The measured are compared with the numerical results. In the range of scattering angles around the specularly reflected direction, the measured retardations are found almost independent of surface profile. In the range of scattering angles around the backscattering direction, large difference results between the measured and numerical results if diffraction is ignored. Taking account of diffraction brings about close relationship between the measured and numerical results.

4th International Conference on Phonon Physics and 8th International Conference on Phonon Scattering in Condensed Matter, July 23-28, 1995, Sapporo, Japan

Advances in Stanford phonon-mediated elementary particle detectors

B. CABRERA, P. L. BRINK, B. CHUGG, B. L. Dougherty, K. D. IRWIN, S. W. NAM, A. T. LEE
Department of Physics, Stanford University, Stanford, USA
J. G. Pronko Lockheed Research Laboratories, Palo Alto, USA
S. TAMURA
Department of Engineering Science, Hokkaido University, Sapporo, Japan
B. A. YOUNG
Physics Department, Santa Clara University, Santa Clara, USA

We have demonstrated a new phonon sensor designed based on aluminum phonon collection pads connected to tungsten transition-edge sensors (TES). The device is patterned onto a silicon crystal and phonons produced by events in the Si are absorbed into the aluminum films where about half of the energy is converted into long-lived quasiparticle excitations. Current changes induced by particle events are measured with a high-band width SQUID amplifier readout. We have completed a new analysis of the nuclear recoil versus electron recoil ballistic phonon production experiments which used our earlier generation Ti TES on Si crystals. The new result set an upper limit on the distinction between the two phonon spectra and provide a better understanding of the phonon sensor response.

4th International Conference on Phonon Physics and 8th International Conference on Phonon Scattering in Condensed Matter, July 23-28, 1995, Sapporo, Japan

Dynamical properties of phonons in single- and double-superlattice systems

S. MIZUNO and S. TAMURA
Department of Engineering Science, Hokkaido University, Sapporo, Japan

We have studied the dynamical properties of phonons traveling through the single- and double-barrier structures for phonons composed of periodic superlattices. The time development of phonon packets propagating through these systems are calculated both numerically and analytically. In a system with a single barrier the time advance and delay are found for the

transmitted and reflected packets, respectively. On the other hand, in a double barrier system, large time delays are found for both packets. These results are well understood based on the formulas of the asymptotic phase times for phonons we have derived. Our results should provide an important information on the response times of phonon optics devices utilizing semiconductor superlattices.

4th International Conference on Phonon Physics and 8th International Conference on Phonon Scattering in Condensed Matter, July 23-28, 1995, Sapporo, Japan

Images of surface acoustic waves on the (110) face of cubic crystals with liquid loading

A. IKEHATA, S. TAMURA
Department of Engineering Science, Hokkaido University, Sapporo, Japan
R. E. VINES, J. P. WOLFE
Department of Physics and Materials Research Laboratory,
University of Illinois at Urbana-Champaign, Urbana, USA

We study the effect of liquid loading on surface acoustic waves propagating on the (110) face of cubic crystals. A semiinfinite nonviscous liquid in contact with solid substrate induces new branches of Rayleigh and pseudo-surface waves which are not supported on the free surface. The group velocities are calculated and compared with ultrasound images obtained experimentally.

4th International Conference on Phonon Physics and 8th International Conference on Phonon Scattering in Condensed Matter, July 23-28, 1995, Sapporo, Japan

Enhancement of mode-converted transmission of phonons in superlattices

H. KATO Tomakomai National College of Technology, Tomakomai, Japan
H. J. MARIS
Department of Physics, Brown University, Providence, USA
S. TAMURA
Department of Engineering Science, Hokkaido University, Sapporo, Japan

We study the transmission and reflection of phonons incident on a superlattice at an oblique angle. For frequencies in the vicinity of an anti-crossing frequency in the superlattice phonon dispersion relation we find that the wave energy oscillates back and forth between the different polarizations as the wave propagates through the superlattice. These oscillations are analogous to the Pendellosung effect for electrons and X-rays.

4th International Conference on Phonon Physics and 8th International Conference on Phonon Scattering in Condensed Matter, July 23-28, 1995, Sapporo, Japan

Electron scattering rates due to confined and resonant acoustic phonons in a quantum wire

N. NISHIGUCHI
Department of Engineering Science, Hokkaido University, Sapporo, Japan

We analytically study electron scattering due to acoustic phonons via the deformation potential in a quasi-one-dimensional (Q1D) cylindrical semiconductor wire embedded within another bulk material, considering acoustic phonon modes peculiar to the system. Owing to the Q1D wire structures, confined acoustic phonon modes exist even for an embedded wire within another bulk medium. Extended acoustic phonon modes are also modulated in the wire region, and resonant acoustic phonon modes related to wire dimensions appear. We make it clear the modifications in electron scattering rates due to these acoustic phonon modes by comparing the scattering rates assuming the usual 3D bulk phonons.

4th International Conference on Phonon Physics and 8th International Conference on Phonon Scattering in Condensed Matter, July 23-28, 1995, Sapporo, Japan

Acoustic phonon modes in a quantum wire

N. NISHIGUCHI
Department of Engineering Science, Hokkaido University, Sapporo, Japan

Confined, interface and extended acoustic phonon modes in a cylindrical quantum wire embedded in another material are analytically investigated based on the elastic continuum model by means of the potential theory. These acoustic phonon modes are coupled modes of longitudinal and transverse acoustic waves, classified due to rotational symmetry of the modes. We examine the dispersion relations of the confined modes and investigate the regions of material parameters for the possible existence of interface modes. As for the extended phonon modes, we will show that resonant phonon modes related to wire dimensions have large amplitude in the wire region.

The Third ECAMI (European Canadian Mesoscopic Initiative) Workshop June 12-14, 1996, Ottawa, Canada

Possibilities of Quantum Boxes for Memory Applications

Shunichi MUTO
Faculty of Engineering, Hokkaido University, N13,W8, Kitaku, Sapporo 060, Japan
Yoshihiro SUGIYAMA, Yoshiaki NAKATA, Kenichi IMAMURA,
Yoshiki SAKUMA, Toshihiko MORI, and Naoki YOKOYAMA
Fujitsu Limited, 10-1 Morinosato-Wakamiya, Atsugi 243-01, Japan

Recent progress in semiconductor crystal growth made it possible to fabricate quantum boxes (also known as quantum dots) in a rather simple manner using the self-organizing mechanism. Two proposals of memory application of quantum boxes are described.

1. Frequency Domain Optical Storage Using Size Distributed Quantum Boxes
2. Application of Quantum Boxes for Improved SRAM by ME-RHET

Combined Conference of the 4th International Conference on Phonon Physics and the 8th International Conference on Phonon Scattering in Condensed Matter July 23-28, 1995, Sapporo, Japan

Structural Properties of As-grown and Reduced Pr_2CuO_4 Single Crystals Investigated by Ion Channeling

T. HAGA and Y. ABE
Department of Nuclear Engineering, Hokkaido University,
Sapporo 060, Japan

In order to clarify a role of reduction for Pr_2CuO_4, ion channeling properties for the materials have been measured in detail. Anomalous increases of dechanneling fractions of Cu and O atoms in the reduced samples have been found. These results could not be explained by the apical oxygen model but probably suggest that O atoms in Cu-O planes are removed by reduction.

16th International Conference on Amorphous Semiconductors, Kobe, September 4-8, 1995

Photoinduced Phenomena in As_2S_3 Glass under Sub-Bandgap Excitation

Keiji TANAKA and Hisataka HISAKUNI
Department of Applied Physics, Faculty of Engineering,
Hokkaido University

It is known that chalcogenide glasses exhibit a variety of photoinduced phenomena. Among these, the so-called reversible photostructural and optical changes have attracted considerable interests. The phenomena are believed to be induced with bandgap light; $\hbar\omega > E_g$, where $\hbar\omega$ is the photon energy and E_g is the optical bandgap energy. Sub-bandgap illumination ($\hbar\omega < E_g$) has been assumed to be ineffective, or at least, less effective. We demonstrate that sub-bandgap illumination can induce dramatic photoinduced changes.

16th International Conference on Amorphous Semiconductors, Kobe, September 4-8, 1995

Photostructural Changes in Amorphous Selenium : an in-situ EXAFS Study at Low Temperature

Alexander V. KOLOBOV[*1], Hiroyuki OYANAGI[*2], Kazunobu TANAKA[*1] and Keiji TANAKA[*3]
[*1] Joint Research Center for Atom Technology-National Research Institute for Advanced Interdisciplinary Research
[*2] Electrotechnical Laboratory
[*3] Department of Applied Physics, Faculty of Engineering, Hokkaido University

Detailed microscopic mechanism of reversible photostructural changes in amorphous chalcogenide semiconductors still remains controversial. Most structural measurements, such as Raman spectroscopy or extended X-ray absorption fine structure (EXAFS), were done on $As_2S(e)_3$, i.e. on binary semiconductors, which made the data analysis complicated. Besides, all previous measurements were done ex-situ, i.e. a sample before light irradiation and after light irradiation was studied but not a sample kept under light irradiation during the measurement. As a result, the information about the excited state of the semiconductor and hence about the microscopic mechanism of the process was missing. We report in-situ EXAFS measurements of amorphous Se.

16th International Conference on Amorphous Semiconductors, Kobe, September 4-8, 1995

Transient Photoconduction and Photoinduced Phenomenon in Ion-Conducting Amorphous Semiconductors

Mikitaka ITOH, Norimitsu YOSHIDA, Hirohisa TANAKA and Keiji TANAKA
Department of Applied Physics, Faculty of Engineering, Hokkaido University

Ag-As-Se(S) glasses having mixed ion-hole conduction exhibit interesting photoinduced phenomena, such as photodoping and photosurface deposition. These phenomena appear to be caused by interaction between photoexcited carriers and Ag^+ ions, while details of photo-electro ionic properties in these glasses have not been studied. We investigate the transient photoconduction and the photoinduced chemical modification phenomenon in Ag-As-Se(S) glasses, in which the Ag content is varied at 0-35 at. %.

16th International Conference on Amorphous Semiconductors, Kobe, September 4-8, 1995

Photo-and Electron-induced Chemical Modifications in Ag-As(Ge)-S(Se) Glasses

Norimitsu YOSHIDA, Mikitaka ITOH and Keiji TANAKA
Department of Applied Physics, Faculty of Engineering,
Hokkaido University

It is known that Ag-containing chalcogenide glasses such as Ag-As(Ge)-S(Se) systems exhibit mixed conductivity comprising of Ag^+ ions and holes. In these systems, we have demonstrated a photoinduced chemical modification phenomenon, in which Ag^+ ions migrate from dark to illuminated regions. It is also known that in these systems electron-beam irradiation induces migration of Ag. However, the Ag-migration behaviors induced by light and electron beams have not been studied in a unified way. The purpose of the present study is to investigate comparatively the photoinduced and the electron-beam-induced effect in melt-quenched Ag-As(Ge)-S(Se) bulk glasses with the Ag content of 15-35 at. %

10th International Conference on Dynamical Processes in Excited States of Solids, Cairns, Queensland, Australia August 29-September 1, 1995

An in-situ EXAFS Study of Amorphous Selenium : the Formation of Dynamical Bonds under Light Excitation

Alexander V. KOLOBOV[*1], Hiroyuki OYANAGI[*2], Kazunobu TANAKA[*1] and Keiji TANAKA[*3]
[*1] Joint Research Center for Atom Technology-National Research Institute for Advanced Interdisciplinary Research
[*2] Electrotechnical Laboratory
[*3] Department of Applied Physics, Faculty of Engineering, Hokkaido University

Amorphous chalcogenides are unique materials which exhibit light-induced metastable structural changes. All previous studies were done ex situ, i. e. samples before and after light irradiation were studied but not a sample under light excitation. As a result, information about the structure in the excited state, and hence about the mechanism of structural changes, was missing. We report the results of the first in-situ study of this process in amorphous selenium (a-Se). Extended X-ray absorption fine structure (EXAFS) spectroscopy has been

used. We have observed an increase of the average coordination number under light excitation by 4% with simultaneous increase in the mean-square relative displacement by 20%. The change in the coordination is dynamical-initial coordination is restored after switching the light off-and is attributed to the formation of dynamical interchain bonds in a-Se under light excitation. Possible mechanisms are discussed.