Technical Report to ONR

1996 Spring MRS Meeting, Symposium B:
Defects and Interfaces in Lattice-Mismatched Semiconductor Heterostructures

Symposium Chair: P.M. Mooney (IBM)
Co-Chairs: K.L. Kavanagh (UCSD), L.J. Brillson (Xerox) and B.W. Wessels (NWesern U.)

Symposium B - Defects and Interfaces in Lattice-Mismatched Heterostructures, was considered a great success by all concerned. It filled 3 days and was well attended by approximately 100 attendees/day. We invited 12 speakers from a range of expertise which helped to attract 97 abstracts, 22 of which were rejected, 32 designated as posters and 43 talks. The symposium emphasized problems common to every semiconductor heterostructure with the aim of bringing together scientists working on different lattice-mismatched semiconductor systems. Thus, the session titles, listed below, reflected this approach as much as possible.

Session B1: Interface Roughening and Interdiffusion in Heterostructures
Session B2: Properties of Dislocations and Effects of Substrate Miscut
Session B3: Strain Relaxation in Heterostructures
Session B4: Strain Relaxation/Dislocations in SiGe (Jointly with Symp F - GeSi and Related Compounds)
Session B5: Poster Session
Session B6: Defects in Quantum Structures
Session B7: Defects in ZnSe-Based Heterostructures

We were able to obtain MRS corporate sponsorship for our symposium totaling $5000. Adding the $2000 support from ONR brought our total budget to $7000. This was consumed by registration fees and travel support of the invited speakers, symposium organizers and session chairs as detailed in the attached budget summary.

Highlights of the Sessions

Applications of lattice-mismatched semiconductor heterostructures for state-of-the-art electronic and optoelectronic devices discussed in this symposium included blue-green lasers fabricated from II-VI semiconductors, various quantum structures fabricated with III-V semiconductors, and high-speed field effect transistors (FETs) utilizing strained Si or SiGe layers on relaxed SiGe buffer layers. Although the dislocations threading through the SiGe buffer layers are electrically active, concentrations are low enough that their effects on low temperature electron mobility are negligible. New results on the fundamental properties of dislocations include the real time observation of the motion of dislocation kinks in plastically deformed Si by high resolution transmission electron microscopy and the observation by spatially resolved electron energy loss spectroscopy of changes in the electronic structure of the heterojunction in the vicinity of a misfit dislocation near the interface between a strained Si layer on relaxed SiGe. Calculations of the modification of the surface morphology of
SiGe films due to mismatch strain and resulting compositional variations in the layer were also reported as were calculations of the strain redistribution both the SiGe film and the Si substrate.

Fundamental issues associated with strain relaxation mechanisms and interface roughness were addressed in many of the talks on III-V materials. The usefulness of high resolution x-ray diffraction techniques including both topography and reciprocal space mapping for evaluating the quality of epitaxial layers and for the study of strain relieving defects was demonstrated. In-situ x-ray topography was carried out during molecular beam epitaxy growth of InGaAs/GaAs heterostructures at a synchrotron source. By correlating the x-ray images with localized transmission electron microscopy images the nature of the misfit dislocation sources at the interface as a function of epilayer thickness was determined. Linearly polarized cathodoluminescence imaging was applied to the study of III-V semiconductor heterostructures. Local variations in excitonic polarization anisotropy, emission energy and activation energy are found to correlate spatially with dark-line defects in the material. Investigations of interface uniformity using cross-sectional STM was described.

A dramatic improvement in the defect density of ZnSe-based heteroepitaxial structures for blue-green laser diodes was announced. Employing a combination of homoepitaxial buffer layers, improved pregrowth wafer handling, Zn irradiation, and migration enhanced epitaxy on c(4x4) ordered GaAs surfaces, the an etch pit density of $1-3 \times 10^3 \text{ cm}^{-2}$ was achieved. Such defect density reductions are closely tied to improvements in expected laser diode lifetimes. Dramatic improvements in ZnCdSe epilayers on InP were also achieved by optimizing initial growth and substrate preparation procedures. A mechanism for the degradation of ZnSe-based heteroepitaxial diode laser structures based on the emission of a cluster of vacancies from Frank-type stacking faults, leading to strain generation of small dislocation loops and the formation of dark line defects was proposed.
### 1996 SPRING MEETING

**BUDGET SUMMARY**

**SYMPOSIUM B**

[Karen Kavanagh]

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**Total**

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**Prepared By:** Donna Gillespie

**Date Prepared:**


**DRAFT FINAL:**

5/14/96

**ACCOUNT CLOSED:**

6/7/96

**ONR:** 5 copies of a Technical Report for ONR due to MRS Hqs.
SYMPOSIUM B

DEFECTS AND INTERFACES IN LATTICE-MISMATCHED SEMICONDUCTOR HETEROSTRUCTURES
April 8 - 10, 1996

Chairs
Patricia M. Mooney
IBM T.J. Watson Research Center

Karen L. Kavanagh
University of California, San Diego

Bruce W. Wessels
Xerox Wilson Center for Research and Technology
Northwestern University

Leonard J. Brillson
Symposium Support
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Philips Electronic Instruments Co.
Xerox Wilson Center for Research and Technology
Office of Naval Research

*Invited Paper

SESSION B1: INTERFACE ROUGHENING AND INTERDIFFUSION IN HETEROSTRUCTURES
Chair: K.L. Kavanagh and L. Tiedje
Monday Morning, April 8
Sunset E

8:30 A.M. **B1.1**
THE STABILITY OF HETEROEPITAXIAL THIN FILMS, J.E. Geyer, H. von Weng, S. Davis, M.J. Misikis and P.W. Voorhees, Northwestern University, Department of Materials Science and Engineering, Evanston, IL.

9:00 A.M. **B1.2**
MECHANISMS OF PLASTIC RELAXATION IN HETEROEPITAXIAL SEMICONDUCTOR GROWTH, Horst P. Strunk, Martin Albrect, Silke Christiansen and Johannes Miehle, Institut fuer Werkstoffwissenschaften, Lehrstuhl Mikrostrukturierung, Erlangen, Germany.

9:30 A.M. **B1.3**
STABILITY MAPS FOR STRAINED LAYER EPITAXY: KINETIC MODELS AND EXPERIMENTAL DATA FROM MBE AND UHV CVD OF SI, Ge(001), Si, H, Implanted Si, J.A. Baribeau, Institute for Microstructural Sciences, National Research Council of Canada, Ottawa, Canada; B. Balibar-Scobie, University of Toronto, Toronto, Canada.

9:45 A.M. **B1.4**
KINETIC PATHWAYS TO STRAIN RELAXATION IN THE SI-Ge SYSTEM, D.S. Jesson, K.M. Chen, S.J. Penycook, Oak Ridge National Laboratory, Solid State Division, Oak Ridge, TN; T. Thundat and R.J. Warmack, Oak Ridge National Laboratory, Health Science Research Division, Oak Ridge, TN.

10:00 A.M. A.M. BREAK

10:30 A.M. **B1.5**

11:00 A.M. **B1.6**
ATOMIC SCALE DIFFUSION PROCESSES AND RELIABILITY OF LOW-TEMPERATURE-GaAs BASED DEVICES, Christian Kitchin, University of California, Materials Science Department, Berkeley, CA; Ryoichi Sohn and Agnieszka Lillenthal-Weber, Lawrence Berkeley Laboratory, Materials Science Division, Berkeley, CA.

11:15 A.M. **B1.7**
STRUCTURE AND STABILITY OF DEFECTS IN AN In,Ga,As/Al,Ga,As HETEROSTRUCTURE: A THEORETICAL STUDY, Amore Benegato Aldo, Instituto di Chimica dei Materiali, Consiglio Nazionale delle Ricerche, Monterotondo, Italy.

11:30 A.M. **B1.8**
CfToT STUDIED BY PHOTOELECTRON SPECTROSCOPY, R. Sporken, F. Malengean, J. Ghijsten, R. Caudano, Facultés Universitaires Notre-Dame de la Paix, LISE, Namur, Belgium; S. Sivanathan, J.P. Faure, University of Illinois at Chicago, Chicago, IL; T. Bistl, T. Von Gemmeren and R.L. Johnson, Universität Hamburg, Hamburg, Germany.

11:45 A.M. **B1.9**
DEFECTS IN HIGHLY IN-DOPED MOCVD GROWN CdTe ON GaAs, T. Filz, J. Hannan, V. Ovsheim, H. Wolf and Th. Wichert, Universität des Saarlandes, Technische Physik, Saarbrücken, Germany.

SESSION B2: PROPERTIES OF DISLOCATIONS AND EFFECTS OF SUBSTRATE MISCAST
Chair: R. Hull and H. Strunk
Monday Afternoon, April 8
Sunset E

1:30 P.M. **B2.1**
DIRECT OBSERVATIONS OF DISLOCATION KINKS BY THEORETICAL-INITI CALCULATIONS OF KINK ENERGIES, John C. Spence, H. Kolar and Y. Huang, Arizona State University, Department of Physics, Tempe, AZ.

2:00 P.M. **B2.2**
SPATIALLY RESOLVED ELECTRONIC STRUCTURE OF SILICON QUANTUM WELLS IN THE PRESENCE OF MISFIT DISLOCATION STRUCTURES, P.E. Batista, IBM Thomas J. Watson Research Center, Yorktown Heights, NY.

2:30 P.M. **B2.3**
MISFIT DISLOCATION INTERACTIONS OBSERVED IN InGaAs ON OFF-CUT, PATTERNED GaAs BY CATHODOLUMINESCENCE, G.P. Watson, AT&T Bell Laboratories, Murray Hill, NJ; and D.G. Ast, Cornell University, Materials Science and Engineering Department, Ithaca, NY.

2:45 P.M. **B2.4**
STRUCTURAL AND OPTICAL STUDY OF InGaAs BUFFER LAYERS COMPOSITIONALLY GRADED WITH DIFFERENT LAYERS, A. Bosshard, A.C. deRouck, C. Ferrari, S. Franzini, L. Lazzarini, G. Salvati, MASPEC-CNR Institute, Parma, Italy; A.V. Drigo and F. Romano, University of Padova, INFN, Physics Department, Padova, Italy.

3:00 P.M. BREAK

3:30 P.M. **B2.5**
EFFECTS OF GaAs SUBSTRATE MISORIENTATION ON PROPERTIES OF InGaAs/InAlAs HETEROSTRUCTURES, R.S. Goldman, Carnegie-Mellon University, Department of Physics, Pittsburgh, PA; K.L. Kavanagh, H.H. Wieder, University of California, San Diego, Department of Electrical and Computer Engineering, La Jolla, CA; S.N. Ehrlich, Purdue University, School of Materials Engineering, West Lafayette, IN; R.M. Feenstra, Carnegie Mellon University, Department of Physics, Pittsburgh, PA.

3:45 P.M. **B2.6**
STRAIN RELAXATION AND DEFECT GENERATION IN ZnSe/GaAs GROWN BY LOW-PRESSURE OEP, S. Ruvimtsova, Zymiana Lillenthal-Weber, Edward B. Boret, X.W. Lin, Young Chen and Jack Wachtbun, Lawrence Berkeley National Laboratory, Berkeley, CA.

4:00 P.M. **B2.7**
THE POSSIBILITY OF CaAs SUBSTRATES WITH ULTRA-LAW THADING DISLOCATION DENSITIES, Gnan MacPherson and P.J. Goodhew, University of Liverpool, Department of Materials Science and Engineering, Liverpool, United Kingdom.

4:15 P.M. **B2.8**
HETEROEPITAXY OF STRAINED-LAYER InAsSb, S.C. Therring and B.W. Wessels, Northwestern University, Department of Materials Science and Engineering, Evanston, IL.

4:30 P.M. **B2.9**
STRAIN RELAXATION IN LARGE MISMATCHED CdTe EPITAXY GROWN ON (211) Si BY MOLECULAR BEAM EPITAXY, H. Wei, L. Salameh-Riba, University of Maryland, Department of Materials and Nuclear Engineering, College Park, MD; N.K. Dhar, US Army Research Laboratory, Fort Belvoir, VA.

4:45 P.M. **B2.10**
THE EFFECT OF SUBSTRATE MISORIENTATION ON STRAIN RELAXATION MECHANISMS IN EPITAXIALLY GROWN CdS/Si(111) HETEROSTRUCTURES, B.R. Kim, S.R. Son, L.J. Shewalter, Rensselaer Polytechnic Institute, Physics Department and Center for Integrated Electronics and Electronics Manufacturing, Troy, NY; and Thomas G. Thundat, Oak Ridge National Laboratory, Oak Ridge, TN.

SESSION B3: STRAIN RELAXATION IN HETEROSTRUCTURES
Chair: P.M. Mooney and G. Salvati
Tuesday Morning, April 9
Sunset E

8:30 A.M. **B3.1**
THE KEY ROLE OF X-RAY DIFFRACTION ANALYSIS IN THE DEVELOPMENT OF STRAINED LAYER DEVICES, L.C. Basiniiana.
2:30 P.M. B4.3/F2.3
ELECTRICAL CONDUCTIVITY TYPE CONVERSION DUE TO STRAIN-RELAXATION RELATED DEFECTS IN GeSi/Si, P.N. Grillot, S.A. Ringel, Ohio State University, Electronic Materials and Devices Laboratory and Department of Electrical Engineering, Columbus, OH; E.A. Fitzgerald and J. Michel, Massachusetts Institute of Technology, Department of Materials Science and Engineering, Cambridge, MA.

2:45 P.M. B4.4/F2.4
ELECTRICAL ACTIVELY DISLOCATION-RELATED STATES IN RELAXED SIE LAYERS, P.M. Moneye, L.P. Tilly, C.P. D'Emic and J.O. Chu, IBM T.J. Watson Research Center, Yorktown Heights, NY.

3:00 P.M. BREAK

3:30 P.M. B4.5/F2.5
INFLUENCE OF MISFIT DISLOCATION INTERACTIONS ON PHOTOULTRASOUND SPECTRA OF SIE ON PATTERNED SI, G.P. Watson, J.L. Benton, Y.H. Xie, AT&T Bell Laboratories, Murray Hill, NJ; and E.A. Fitzgerald, Massachusetts Institute of Technology, Department of Materials Science and Engineering, Cambridge, MA.

3:45 P.M. B4.6/F2.6
ELECTRICAL ACTIVITY OF DISLOCATIONS IN SIE/Si STRUCTURES, Martin Kitter, Institute of Halbleiter Physik, Frankfurt, Germany; and Victor Higgs, Bio-Rad, Semiconductor Division, Hertfordshire, United Kingdom.

4:00 P.M. B4.7/F2.7
DISLOCATIONS NUCLEATION IN STRAINED LAYER EPITAXY: A BRITTLE-TO-DUCTILE PHENOMENON, Steven Labovitz, David Pope, Pennsylvania State University, Department of Materials Science and Engineering, Philadelphia, PA; and Ya-Hong Xie, AT&T Bell Laboratories, Silicon Materials, Murray Hill, NJ.

4:15 P.M. B4.8/F2.8
REAL TIME MEASUREMENTS OF ELASTIC AND PLASTIC STRAIN KINETICS DURING SIE MBE GROWTH, J.A. Flory, E. Chason and S.R. Lee, Sandia National Laboratories, Albuquerque, NM.

4:30 P.M. B4.9/F2.9

SESSION B5: POSTER SESSION
Tuesday Evening, April 9
8:00 P.M. Presidio Ballroom

B5.1 DEEP-LEVEL DEFECTS AT TITANIUM PLANEAR-DOPED GaAs INTERFACES STUDIED BY CAPACITANCE SPECTROSCOPY, P. Krupin, Paul-Dreude-Institut für Festkörperphysik, Berlin, Germany.

B5.2 OPTICAL STUDIES OF EXTREMELY HEAVILY DOPED STRAINED SI TIN FILMS, H. Yao, University of Nebraska, Department of Electrical Engineering, Lincoln, NE; H.-J. Grossmann, A.R. Kortan, T. Boone, AT&T Bell Laboratories, Murray Hill, NJ.

B5.3 UHV-HEEM AND XP SPECTROSCOPY OF ROOM TEMPERATURE Au DEPOSITION ON S1(001)-2X1, Eric Landers, Daniel Grozea, Christopher Collazo-Davila and L.D. Marks, Northwestern University, Department of Materials Science and Engineering, Evanston, IL.

B5.4 OPTICAL PROPERTIES OF HEAT TREATED CRYSTALS OF ZnSe: In Se ATMOSPHERE, C. Uribe-Estrada and I. Hernandez-Calderon, CNVESTAV, Physica Department, Mexico, Mexico; and R. Felipe, University of San Luis Potosi, Physics Department, San Luis Potosi, Mexico.

B5.5 ARSENIC PRECIPITATION BEHAVIOR IN InGaAs/InAs SUPERLATTICES GROWN BY LOW TEMPERATURE MOLECULAR BEAM EPITAXY, Chan-Grune Park, Chao Ho Park, Postech, Department of Materials Science and Engineering, Pohang, Korea; Sam-Kyu Noh, Hwack-Joo Lee and Chang Seh Kim, Kuris, Material Evaluation Center, Taegu, Korea.

B5.6 NONLINEAR OPTICAL PROPERTIES OF (InP)/GaP) BILAYER SUPERLATTICE STRUCTURES, Y. Tang, H.T. Lin, D.H. Rich, University of Southern California, Department of Materials Science and Engineering, Los Angeles, CA; P. Collier and S.M. Vernon, Spire Corporation, Bedford, MA.

B5.7 BEEM AND STM STUDIES OF SELF ASSEMBLED InAs ISLANDS, M.E. Rubin, E.Y. Lee, J.J. O'Shea, M.A. Chin, G. Medeiros-Ribeiro, P.M. Petroff, V. Narayananurty, University of California, Department of Materials Science and Engineering, Santa Barbara, CA.

SESSION B4/F2: STRAIN RELAXATION/DISLOCATIONS IN GeSi
Chair: D.W. Grove
Tuesday Afternoon, April 9
Sunset E
1:30 P.M. B4.1/F2.1
RELAXED GeSi/Si: MATERIAL LIMITS, DETECTORS AND TEMPLATES, E.A. Fitzgerald, Massachusetts Institute of Technology, Department of Materials Science and Engineering, Cambridge, MA.

2:00 P.M. B4.2/F2.2
CORRELATION BETWEEN DISLOCATIONS AND ELECTRON TRANSPORT PROPERTIES IN Si/GeSi, K. Ismail, IBM T.J. Watson Research Center, Yorktown Heights, NY.

SESSION B3/F2: STRAIN RELAXATION/DISLOCATIONS IN GeSi
Chair: D.W. Grove
Tuesday Afternoon, April 9
Sunset E
1:30 P.M. B3.1/F2.1
RELAXED GeSi/Si: MATERIAL LIMITS, DETECTORS AND TEMPLATES, E.A. Fitzgerald, Massachusetts Institute of Technology, Department of Materials Science and Engineering, Cambridge, MA.

2:00 P.M. B3.2/F2.2
CORRELATION BETWEEN DISLOCATIONS AND ELECTRON TRANSPORT PROPERTIES IN Si/GeSi, K. Ismail, IBM T.J. Watson Research Center, Yorktown Heights, NY.
B6.8 PROPERTIES OF METASTABLE InGaAs/ GaAs(100) QUANTUM DOTS (QD) STRUCTURE GROWN BY MOLECULAR BEAM EPITAXY (MBE). Jeong-Hoon Yoon, Choel-Koo Han, In-Sang Joon, Jun-Woo Lee, Moo-Sung Kim, Sun-Ki Yoon, Myeong-Hoon Cho, KIST, Semiconductor Materials Research Laboratory, Seoul, South Korea.

B6.9 ANALYSIS OF UNDULATION ON THE PATTERNED SUBSTITUTE IN THE STRAINED LAYER MQW DISTRIBUTED FEEDBACK LASER DIODES. Brunt Mun Kim, Hong Soo Kim, Hyo Kim, Heung Ro Choi, Young Min Kim and Sung-Eun Pyun, Electronics and Telecommunications Research Institute, Compound Semiconductor Department, Daegu, Korea.

B6.10 INTERFACE ROUGHNESS IN TILT ED GaSb/InAs SUPERLATTICES. S.W. da Silva, Yu. A. Pusey, J.C. Galzani, Universidade Federal de Sao Carlos, Sao Carlos, Brazil; D.I. Lubyhev, M.G. Gonzalez-Borrero, P. Bajjau, Universidade de Sao Paulo, Instituto de Fisica de Sao Carlos, Sao Carlos, Brazil; and A. Gutakowskii, Institute of Semiconductor Physics, Novosibirsk, Russia.

B6.11 MEASUREMENT OF INTERFACE FLATNESS WITH SECONDARY ION MASS SPECTROMETRY (SIMS). Jon W. Erickson, J. Ivanov, Charles Evans and Associates, Redwood City, CA; S.H. Benscosa, A. Benscosa, Mark H. Hurwitz, Space Vacuum Epitaxy Center, Houston, TX; and I. Rusakova, University of Houston, Texas Center for Superconductivity, Houston, TX.

B6.12 GaSb(100) SURFACE MORPHOLOGY: VARIATION WITH GROWTH TEMPERATURE. Stuart J. Brown, Michael P. Grimshaw, David A. Ritchie and Gerard E. A. Jones, University of Cambridge, Cavendish Laboratory, Cambridge, United Kingdom.

B6.13 EFFECT OF ANNELING TEMPERATURE ON STRAIN IN OPTICALLY PATTERNED FILMS ON PATTERNED SI SUBSTRATES. K. Ram Mohan, D.H. Rich, University of Southern California, Department of Materials Science and Engineering, Los Angeles, CA; M.H. MacDougall and P.D. Dapkus, University of Southern California, Department of Electrical Engineering and Department of Materials Science and Engineering, Los Angeles, CA.

B6.14 PSEUDOMORPHIC GROWTH CONDITIONS FOR ZnSe-BASED II/VI LASERS GROWN ON (001) GaAs SUBSTRATES. L. Zhao, B. Greenberg, E. Smekts, J. Galves and Petruzello, Philips Laboratories, Briarcliff Manor, NY.

B6.15 DIFFUSE SCATTERING FROM STACKING FAULTS ORIGINATING AT THE ZnSe/GaAs INTERFACE. Greg U'Reg, Sandra Lindo, Mark Goorsky, University of California, Los Angeles, Department of Materials Science and Engineering, Los Angeles, CA; Greg M. Hagen, K.K. Law and Tom Miller, Science Research Laboratory, St. Paul, MN.

B6.16 THE INFLUENCE OF PRELAYERS ON THE SURFACE MORPHOLOGY OF GaAs FILMS GROWN ON COATED Si-Si SUBSTITUTE SUBSTRATES. L.W.P. Hui, University of Virginia, Department of Physics, Charlottesville, VA; E.A. Fitzgerald, Department of Materials Science and Engineering, MIT, Cambridge, MA; J. Kuo, Y.H. Xie and F.J. Silverman, AT&T Bell Laboratory, Murray Hill, NJ.

B6.17 THE CHANGE OF MICROSTRUCTURES IN SiGe FILM GROWN ON (001) Si SUBSTITUTE USING SPE METHOD. Seo-Gi Kim, Sahn Nahm, Jin Sun, Hyo Min, Kyoung-Ich Ko, In-Ho Bae, Jae-Jin Lee and Kee-Soo Nam, Electronics and Telecommunications Research Institute, Semiconductor Division, Taejon, Korea.

B6.18 STUDY OF EPITAXIAL SiGe, GROWTH BY SOLID PHASE EPITAXY AND PULSED LASER DEPOSITION. M.E. Taylor, G. He, H.A. Atwater, J. M. Watson, California Institute of Technology, Laboratories of Applied Physics, Pasadena, CA; and A. Polman, FOM Institute for Atomic and Molecular Physics, Amsterdam, Netherlands.

B6.19 THERMAL RELAXATION OF STRAINED SiGeALLOYS ON Si(001). Sean S. Seo, Robert J. Cohenburg, Arizona State University, Department of Physics and Astronomy, Tempe, AZ; Andy E. Bair and T.L. Alfred, Arizona State University, Department of Chemical Bio and Materials Engineering, Tempe, AZ.

B6.20 RELAXATION, DEFECT DISTRIBUTION AND SURFACE MORPHOLOGY IN HIGHLY MISFITTED InGaAs/GaAs HETEROSTRUCTURES. L. Francesco, P. Fransozi, L. Lazzaroni, G. Saccani, MASPEC-CNR, Institute, Parma, Italy; M.R. Brun, G. Peddilet and M.G. Simba, ICMAT-CNR Institute, Roma, Italy.

B6.21 STABILITY OF EPITAXIALLY STRAINED SEMICONDUCTOR STRIPES. A. Atkinson, Imperial College of Science Technology and Medicine, Department of Materials, London, United Kingdom; C.S. Jain and K. Pinardi, IMEC, Kapeldreef, Leuven, Belgium.

B6.22 InAs/AlAs/GaAs RESONANT INTERBAND TUNNELING DIODES ON GaAs SUBSTRATES. Kumar Shirahati, Jun Shen, Raymond Tsul, Motorola, PCL, Tempe, AZ.

B6.23 GROWTH KINETICS OF SiGe, FILMS ON Si(100) WITH Y=0.05 AND T=450-540°C. Harald Jacobson, Nicole Herbots, Sean Heenan, Joan Xiang and Paul W. Arizona State University, Department of Physics and Astronomy, Tempe, AR.

B6.24 STRAIN RELAXATION OF <111> ORIENTED InGaAs/GaAs SINGLE LAYERS AND MULTIQUNTUM WELL (MQW) STRUCTURES. H. Colson, D. Dunstan, University of Surrey, Physics Department, Surrey, United Kingdom; and P. Kidd, University of Surrey, Department of Materials Science and Engineering, United Kingdom.

B6.25 DIRECT EVIDENCE OF THREADING DISLOCATION SUPPRESSION IN GaAs EPILAYERS BY USING LOW-TEMPERATURE GROWN GaAs INTERMEDIATE LAYER. Tow-Chong Chang, Cheng-Ching Pan, Wei-Shing Leng and Leng-Seow Tan, National University of Singapore, Centre for U-Photoelectronics, Department of Electrical Engineering, Singapore.

B6.26 REDUCTION OF DISLOCATION MOBILITY IN InSb, Si/Si(001), Kerstin Winkler, Steve Roberts, University of Oxford, Department of Materials Science and Engineering, Oxford, United Kingdom.

B6.27 THE MICROSTRUCTURE AND ELECTRICAL BEHAVIOUR OF 6H–GROWN AND ANNEALED HEAVILY C-DOPED GaAs AND InAs GROWN BY CHEMICAL BEAM EPITAXY. Simon Westwater, Tim Bullough, Liverpool University, Department of Materials Science, Liverpool, United Kingdom.

B6.28 STRUCTURAL ASPECTS AND ELECTRICAL TRANSPORT PROPERTIES OF THE Si1-xGex/Ge HETEROSTRUCTURE. M. He, J. Kim, F. Klikkhammer, M. Dolle, H.L. Bay and S. Manti, Institut für Schicht- und Ionentechnik, Jülich, Germany.


B6.30 DISLOCATION SELF-ANNIHILATION AND STRAIN IN HETEROEPITAXIAL MATERIALS. Ken Durose and Ruth L. Port, University of Durham, Department of Physics, Durham, United Kingdom.

B6.31 IN-SITU LIGHT SCATTERING MEASUREMENT OF SURFACE ROUGHNESS DURING GROWTH OF InGaAs ON GaAs AND InP SUBSTRATES. Tom H. Pinnington, Tom Tidey, Mario Beaudoin, Bernard Havenaar, Christian Lavoie and Ahmad Mohades-Kassai, University of British Columbia, Department of Physics and Astronomy, Vancouver, Canada.

SESSION B6: DEFECTS IN QUANTUM STRUCTURES

Chairs: B.W. Weesel and K.S. Goldman
Wednesday morning, April 10
Sunset E.

8:30 A.M. *B6.1
STUDIES OF CARRIER TRANSPORT AND RECOMBINATION IN PARTIALLY RELAXED InGaAs/GaAs AND InGaAs/GaAs FILMS AND NANOSTRUCTURES USING NOVEL IMAGING EXPERIMENTS. D.H. Rich, University of Southern California, Department of Materials Science and Engineering, Los Angeles, CA.

9:00 A.M. *B6.2
IMPACT OF MBE GROWTH CONDITIONS ON DEEP-LEVEL STATES AT THE INVERTED GaAs/AIAs INTERFACE. P. Kindem and R. Hey, Paul-Drude-Institut für Festkörperelektronik, Berlin, Germany.

9:15 A.M. B6.3
OPTICAL ANALYSIS OF THE INTERFACE PROPERTIES OF InAs/InP HETEROSTRUCTURES GROWN BY CBE. J. Geurt, Aachen University of Technology, I. Physikalisch RKTH, Aachen, Germany; J. Hermann, R. Mohnblum, I. Physikalisch RKTH, Aachen, Germany; R. Rongen, M. Leya, and R. Wolter, Eindhoven University of Technology, Department of Physics, Eindhoven, Netherlands.

9:30 A.M. B6.4
OPTICAL CHARACTERIZATION OF AlInGaAs/InGaAs QUANTUM WELL STRUCTURES ON InGaAs SUBSTRATES. L. Jedral, C. Edirisinghe, H. Ruda, University of Toronto, Department of Metallurgy and Materials Science, Toronto, Canada; A. Moore, Optoelectronics Division, EC&G Canada Ltd., Vaudreuil, Canada; and B. Lent, Crystral Research Inc., Victoria, Canada.

9:45 A.M. B6.5
OPTICAL ANALYSIS OF MISFIT DISLOCATIONS ON CARRIER RECOMBINATION AND CURRENT GAIN IN InGaAs/GaAs HETEROSTRUCTURE PHOTOCONDUCTORS. H. Lit, D.H. Rich, University of Southern California, Department of Materials Science and Engineering, Los Angeles, CA; O. Sjöholm, M. Ghiason and A. Larsson, Chalmers University of Technology, Department of Optoelectronics and Electrical Measurements, Göteborg, Sweden.

10:00 A.M. BREAK
10:00 A.M. B6.6
THE GROWTH OF HIGH QUALITY InGaAs QUANTUM WELLS ON GaAs (111)A SUBSTRATES, Michael R. Fahy, Interdisciplinary Research Centre for Semiconductor Materials, London, United Kingdom and ATR Optical and Radio Communication Laboratories, Kyoto, Japan; Kazuhisa Fujita, Mitsuo Takahashi, Pablo O. Vaccaro and Toshitake Watanabe, ATR Optical and Radio Communication Laboratories, Kyoto, Japan.

10:05 A.M. B6.7
INFLUENCE OF PHASE TRANSITIONS ON THE OPTICAL AND ELECTRICAL PROPERTIES OF EXPITAXIAL InGaAs/InP HETEROSTRUCTURES, A.I. Balatskykh, A.F. Oskov, A.N. Osipova, E.V. Solov'eva, State Institute of Rare Metals, Moscow, Russia.

11:00 A.M. B6.8
DISLOCATION REDUCTION OF PLANAR AND SELECTIVELY GROWN GaAs LAYERS ON Si SUBSTRATES, K. Siegler, G. Hahn, I.S. Im, A. Hangleiter, D. Haase, A. Dörren, Universität Stuttgart, 4 Physikalisches Institut, Stuttgart, Germany; F. Phillipi, MPI für Metallforschung, Stuttgart, Germany; and F. Scholz, Universität Stuttgart, 4 Physikalisches Institut, Stuttgart, Germany.

11:15 A.M. B6.9
MISMATCH-DRIVEN GROWTH OF InP/GaAs NANO-STRUCTURES: EXPERIMENT AND MODELIZATION, M. Berti, A.V. Drigo and A. Giulianii, Padua University, INFN, Department of Physics, Padova, Italy; M. Mazzer, Imperial College, Department of Materials, London, United Kingdom; G. Rossetto, R. Tordo, ICTMA-CNR Institute, Padova, Italy; and G. Salvati, Maspec-CNR Institute, Parma, Italy.

11:30 A.M. B6.10
DEFECT INTERFACES OF GaAs/InGaAs BY BALLISTIC-ELECTRON-EMISSION MICROSCOPY, (BEEM), E.Y. Lee, S. Bhargava, R. Mirin, K. Luo, M.A. Chin and V. Narayanamurti, University of California, College of Engineering, Santa Barbara, CA.

11:45 A.M. B6.11
MICROANALYTICAL CHARACTERIZATION OF HETEROSTRUCTURES OF ZnSe QUANTUM DOTS SEQUESTERED IN A SILICATE GLASS, Valerie J. Leporey, Subhash H. Ribbud, University of California, Division of Materials Science and Engineering, Davis, CA; and Mark J. Pendry, National Center for Electron Microscopy, Berkeley National Laboratory, Berkeley, CA.

SESSION B7: DEFECTS IN ZnSe - BASED HETEROSTRUCTURES
Chairs: L.J. Brillson and Z. Liliental-Weber
Wednesday Afternoon, April 10
Sunset E

1:30 P.M. B7.1
CONTROL OF DEFECTS IN ZnSe BASED BLUE/GREEN LASER DIODES, R.L. Gunther, J. Han, G.C. Elia, Purdue University, West Lafayette, IN; and A.V. Nurmikko, Brown University, Providence, RI.

2:00 P.M. B7.2
HETEROEPITAXIAL GROWTH OF WIDE BANDGAP II-VI ALLOYS ON InP SUBSTRATES, M. Tamargo, C. Cavus, L. Zeng, B. Yang, City College of New York, Chemistry Department, New York, NY; F. Semendy, A. Gray, N. Bambha, Army Research Laboratory, Ft. Belvoir, VA; E. Sneocks and J. Zhao, Philips Laboratories, Briarcliff Manor, NY.

2:15 P.M. B7.3
STRUCTURAL CHARACTERIZATION OF LATTICE MATCHED ZnCdSe LAYERS GROWN BY MBE ON InP SUBSTRATES, E. Sneocks, L. Zhao and J. Petruzzello, Philips Laboratories, Briarcliff Manor, NY; A. Cavus, L. Zeng, B. Yang and M.C. Tamargo, City College of CUNY, Department of Chemistry, New York, NY.

2:30 P.M. B7.4

2:45 P.M. BREAK

3:15 P.M. B7.5
GROWN-IN DEFECTS THAT GIVE RISE TO DARK LINE DEFECTS IN BLUE II-VI SEMICONDUCTOR DIODE LASER, L. Salamanca-Riba, University of Maryland, Department of Materials and Nuclear Engineering, College Park, MD.

3:45 P.M. B7.6

4:00 P.M. B7.7
QUANTITATIVE ANALYSIS OF THE DEFECT DENSITY AT ZnSe-GaAs INTERFACES BY RAMAN SPECTROSCOPY, J. Geurtjens, Aachen University of Technology, I. Physikalisches Institut RWTH, Aachen, Germany; J. Hermans, I. Physikalisches Institut der RWTH, Aachen, Germany; J. Söllner, Institut für Halbleitertechnik, Aachen, Germany; and M. Heukel, Institut für Halbleitertechnik, Aachen, Germany.

4:15 P.M. B7.8
DARK LINE DEFECTS IN II-VI ZnSe-BASED SINGLE QW LIGHT EMITTING DIODES, J.R. Kim, K.S. Jones, V. Krishnamoorthy, University of Florida, Department of Materials Science and Engineering, Gainesville, FL; and F.S. Zory Jr., University of Florida, Department of Electrical Engineering, Gainesville, FL.

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