

Proceedings of the
18th International Conference
on
Defects in Semiconductors
Part 4

ICDS-18

Sendai, Japan, July 23-28, 1995

Edited by

Masashi Suezawa and Hiroshi Katayama-Yoshida

TRANS TECH PUBLICATIONS
Switzerland • Germany • UK • USA

Part 4

5. DEFECT-RELATED PHENOMENA

5.1. Vibration of Defects and Impurities

Phonon Spectroscopy of Low-Energy Excitations of Defects in Semiconductors

K. Lassmann

1563

Local Vibrational Modes of 3d Elements in Wurtzite Type ZnO and GaN Crystals

P. Thurian, G. Kaczmarczyk, H. Siegle, R. Heitz, A. Hoffmann, I. Broser, B.K. Meyer, R. Hoffbauer and U. Scherz

1571

Anharmonicity of the C_{As} Local Oscillator in Gallium Arsenide

H.Ch. Alt

1577

Calculation of Local Vibrational Modes at Point Defects in Semiconductors

U. Scherz and C. Schrepel

1583

5.2. Diffusion

The Migration of Carbon and Self Interstitials in Silicon

A. Mainwood

1589

Anomalous Diffusion of Phosphorus in Silicon by Pair Diffusion Model and Decrease in Quasi Vacancy Formation Energy

M. Yoshida

1595

Electric-Dipole Spin Resonance of Defects Correlated with the Diffusion of Zn into Si

H. Schroth, R. App, A. Köpf, K. Lassmann, H. Bracht and N.A. Stolwijk

1601

Enhanced Diffusion of Impurities into Solids by Electron Beam Doping

T. Wada, H. Fujimoto and H. Masuda

1607

Interstitials in Silicon Produced by Electron Beam Doping (Superdiffusion)

T. Wada, T. Hagino, H. Fujimoto and H. Masuda

1613

Electron Energy Dependence of Impurity Concentrations in Semiconductors by Electron Beam Doping (Superdiffusion)

T. Wada, K. Yasuda, H. Fujimoto and H. Masuda

1619

Surface Diffusion of Atoms by Electron Beam Doping (Superdiffusion)

T. Wada, H. Fujimoto and H. Masuda

1625

Dopant Diffusion and Stacking Fault in Silicon during Thermal Oxidation

T. Okino, R. Takaue and M. Onishi

1631

Influence of Simultaneously Implanted As⁺ Ions on Diffusivity and Activation Efficiency of B Atoms Implanted into Silicon

K. Yokota, T. Nakamura, F. Miyashita, K. Hirai, H. Takano,

M. Kumagai, Y. Ando and K. Matsuda

1637

Effects of Background Doping Level on Zn Diffusion in GaAs/AlGaAs Multiple-Quantum-Well Structures

N.H. Ky

1643

5.3. Self-Compensation**Study of the Compensating Centres in GaAs:Te by Positron Annihilation**

R. Krause-Rehberg, G. Dlubek and A. Polity

1649

Time-of-Flight in Lithium-Compensated GaAs

S.P. Ingvarsson and H.P. Gislason

1655

The Influence of the Zinc Concentration on the Defect Characteristics of InP

J. Mahony and P. Mascher

1661

Influence of Intrinsic Defects on the Electronic Structure of Non-Stoichiometric CuInS₂ Chalcopyrite Semiconductors

T. Yamamoto and H. Katayama-Yoshida

1667

5.4. Porous Semiconductors**Defects in Porous Silicon: A Study with Optical and Spin Resonance Methods**D.M. Hofmann, B.K. Meyer, P. Christmann, T. Wimbauer, W. Stadler,
A. Nikolov, A. Scharmann and A. Hofstätter

1673

Oxygen Related Defect Centers: The Source of Room Temperature Red Photoluminescence in As-Made and Oxidized Porous Silicon

S.M. Prokes and W.E. Carlos

1679

6. TECHNOLOGICALLY IMPORTANT PROBLEMS

6.1. Grown-in Defects and Dislocations

Review of the Influence of Micro Crystal Defects in Silicon Single Crystals on Gate Oxide Integrity

I. Fusegawa, K. Takano, M. Kimura and N. Fujimaki 1683

Fundamentals of Point Defect Aggregation and Dissolution Phenomena of Crystal Originated Defects in Czochralski Silicon

W. Wijaranakula 1691

Nature of D-Defect in CZ Silicon: D-Defect Dissolution and D-Defect Related T.D.B

J.-G. Park, J.-K. Jung, K.-C. Cho and G.A. Rozgonyi 1697

Relationship between Grown-in Defects and Thermal History during CZ Si Crystal Growth

K. Takano, K. Kitagawa, E. Iino, M. Kimura and H. Yamagishi 1707

Growth Parameters Determining the Type of Grown-in Defects in Czochralski Silicon Crystals

M. Hourai, E. Kajita, T. Nagashima, H. Fujiwara, S. Sadamitsu, S. Miki and T. Shigematsu 1713

Effect of Magnetic Field and Heat Treatment on the Grown-in Defects in MCZ Si Single Crystals

T.M. Tkacheva, G.N. Petrov and L.I. Datsenko 1719

Annealing Behavior of a Light Scattering Tomography Detected Defect near the Surface of Si Wafers

J. Furukawa, N. Iwaoka and H. Furuya 1725

Influence of Point Defect Concentration in Growing CZ-Si on the Formation Temperature of the Defects Affecting Gate Oxide Integrity

T. Iwasaki, H. Harada and H. Haga 1731

Generation of Oxidation Induced Stacking Faults in CZ Silicon Wafers

K. Sueoka, M. Akatsuka, K. Nishihara, T. Yamamoto and S. Kobayashi 1737

Relation between Minute Lattice Strain and Anomalous Oxygen Precipitation in a Czochralski-Grown Silicon Crystal

S. Kimura, T. Ikarashi, A. Tanikawa and T. Ishikawa 1743

Photoluminescence due to Oxygen Precipitates Distinguished from the D Lines in Annealed Si

M. Tajima, M. Tokita and M. Warashina 1749

Lattice Defects in High Quality As-Grown CZ Silicon, Studied with Light Scattering and Preferential Etching Techniques

J. Vanhellemont, G. Kissinger, D. Gräf, K. Kenis, M. Depas, P. Mertens,
U. Lambert, M. Heyns, C. Claeys, H. Richter and P. Wagner

1755

Microdefects in Nitrogen Doped FZ Silicon Revealed by Li⁺ Drifting

W.B. Knowlton, J.T. Walton, J.S. Lee, Y.K. Wong, E.E. Haller,
W.v. Ammon and W. Zulehner

1761

Influence of Al Doping on Deep Levels in MBE GaAs

U.S. Qurashi, M. Zafar Iqbal, N. Baber and T.G. Andersson

1767

Deep Donor-Acceptor Correlations in Low Temperature GaAs

K.P. Korona, M. Kaminska and J.M. Baranowski

1773

Dislocation Reduction of GaAs and AlGaAs on Si Substrate for High Efficiency Solar Cell

T. Soga, M. Yang, T. Kato, T. Jimbo and M. Umeno

1779

Spatial Distribution of Microdefects around Dislocations in Si-Doped GaAs

R. Toba, M. Warashina and M. Tajima

1785

Study of the Dislocation Atmospheres in n-Type GaAs by DSL Photoetching, EBIC and Microraman Measurements

P. Martin, J. Jimenez, C. Frigeri, J. Weyher and K. Sonnenberg

1791

Study of Gallium and Antimony Cluster Formation in GaSb Bulk Crystals Grown from Nonstoichiometric Melts

N.A. Bert, V.V. Chaldyshev, A.E. Kunitsyn, A.G. Milvidskaya and
M.G. Milvidskii

1797

TEM Evaluation of Ordered and Modulated Structures in MBE-Grown InAlAs Crystals on (110)InP

O. Ueda, Y. Nakata and S. Muto

1801

6.2. Process-Induced Defects and Defects in Devices**SF₆/O₂ and CF₄/O₂ Reactive-Ion-Etching-Induced Defects in Silicon Studied by Photoluminescence Spectroscopy: Role of Oxygen**

I.A. Buyanova, A. Henry, B. Monemar, J.L. Lindström, M.K. Sheinkman
and G.S. Oehrlein

1807

Measurements of Polishing-Induced Residual Damages in Silicon Wafers Using Noncontact Photoconductivity Amplitude Technique

Y. Ogita, M. Nakano and H. Masumura

1813

Lifetime Identification of Thermal Oxidation Process Induced Contamination in Silicon Wafers

H. Daio, K. Yakushiji, A. Buczkowski and F. Shimura

1817

Transmission Electron Microscopy of Lattice Defects in CZ-Silicon Wafer Formed by Two-Stage Annealing	1823
S. Ishikawa, M. Matsushita and J. Shimomura	
Rhombic Aggregation of Dislocations in CZ-Si Crystal	1829
K. Minowa, S. Isomae and M. Kitano	
Study of Near-Surface Microdefects in Czochralski-Si Wafers after a CMOS Thermal Process	1835
Y. Kitagawara, K. Aihara, S. Oka and T. Takenaka	
Subsurface Damage in Single Diamond Tool Machined Si Wafers	1841
T.R. Mchedlidze, I. Yonenaga and K. Sumino	
Interface Defects of Bonded Silicon Wafers	1847
M. Reiche, Q.-Y. Tong, U. Gösele and J. Heydenreich	
Direct Bonding of Silicon Wafers with Grooved Surfaces: Characterization of Defects and Application to High Power Devices	1853
I.V. Grekhov, T.S. Argunova, M.Yu. Gutkin, L.S. Kostina and T.V. Kudryavtzeva	
Oxygen Precipitation in CZ Silicon Crystals Contaminated with Iron	1859
J. Jablonski, B. Shen, T.R. Mchedlidze, M. Imai and K. Sumino	
Evaluation Method of Precipitated Oxygen Concentration in Low Resistivity Silicon Wafers Using X-Ray Diffraction	1865
H. Takeno, M. Mizuno, S. Ushio and T. Takenaka	
Precipitates in Antimony Implanted Silicon	1871
Y. Kikuchi, F. Uesugi, M. Kase, M. Yoshida K. Watanabe and I. Hashimoto	
Secondary Defects and Deep Levels in n-Si Induced by High Energy P Ion Implantation	1875
S. Tatsukawa, Y. Nakahara and S. Matsumoto	
High Energy Si, Zn and Ga Ion Implantation into GaAs on Si	1881
M. Tamura and T. Saitoh	
Local Structure Analysis around Arsenic Implanted into Silicon by XAFS Technique	1887
Y. Horii, Y. Kikuchi, M. Kase and S. Komiya	
Effects of Si₃N₄ Films on Diffusion of Boron and Extended Defects in Silicon during Post-Implantation Annealing	1891
Y. Zaitsu, K. Osada, T. Shimizu, S. Matsumoto, M. Yoshida, E. Arai and T. Abe	
Photoluminescence Defect Diagnostics in Poly-Si Thin Films	1897
S.S. Ostapenko, A.U. Savchuk, G. Nowak, J. Lagowski and L. Jastrzebski	

DLTS of Polysilicon Emitter Solar Cells		
D.P. Parton, T. Markvart, P. Ashburn, J.C. Carter and L. Castañer		1903
Photoluminescence Study on Point Defects in SIMOX Buried SiO₂ Film		
K.S. Seol, A. Ieki, Y. Ohki, H. Nishikawa and M. Tachimori		1909
Spin-Dependent Transport in SiC and III-V Semiconductor Devices		
N.M. Reinacher, M.S. Brandt and M. Stutzmann		1915
Room Temperature Defect Etching of III-V Compounds and Alloys Grown on Si Substrate Using Hydrogen Fluoride and Nitric Acid		
H. Nishikawa, T. Soga, T. Jimbo and M. Umeno		1923
ODMR Investigation of Near-Surface Damage Induced by Dry-Etching Process Using GaAs/AlAs Quantum Well Structures		
Y. Mochizuki, M. Mizuta and A. Mochizuki		1927
Novel Technique for Reliable AlGaAs/GaAs Light Emitting Diodes on Si Using GaAs Islands Active Regions		
Y. Hasegawa, T. Egawa, T. Jimbo and M. Umeno		1933
Thermal and Athermal Migration of Ion-Irradiation Defects in Al_{0.3}Ga_{0.7}As/GaAs Heterostructures		
T. Kanayama, T. Wada and Y. Sugiyama		1939
Characterization of Mg+F, Mg+Ar Dual Ion Implanted Al_xGa_{1-x}As (0≤x≤0.75) Layers		
N. Hara, H. Suehiro and S. Kuroda		1943
Atomic-Scale Studies of Point Defects in Compound Semiconductors by Scanning Tunneling Microscopy		
S. Gwo, S. Miwa, H. Ohno, J.-F. Fan and H. Tokumoto		1949
Electrical and Defect Characterization of Sputter Deposited Au and Cr Schottky Barrier Diodes on GaAs		
S.A. Goodman, F.D. Auret and Y. Le Clerc		1955
Optical and Electrical Characterisation of He Plasma Sputtered n-GaAs		
M. Murtagh, S. Hildebrandt, P.A.F. Herbert, G.M. O'Connor, G.M. Crean, F.D. Auret, S.A. Goodman, G. Myburg and W.E. Meyer		1961
Contamination and Cleaning of GaAs-(100) Surfaces		
K. Gutjahr, M. Reiche and U. Gösele		1967
Characterization of Electron Traps in n-InP Induced by Hydrogen Plasma		
Y. Sakamoto, T. Sugino, K. Matsuda and J. Shirafuji		1973

6.3. Gettering

Gettering of Transition Metals in Multicrystalline Silicon

S.A. McHugo, H. Hieslmair and E.R. Weber 1979

Substitutional Gettering of Platinum by Diffusion into Ion-Beam Damaged Silicon

K.B. Nielsen and B. Holm 1985

Gettering of Iron Using Electrically Inactive Boron Doped Layer

H. Tomita, M. Saito and K. Yamabe 1991

Ab Initio Calculation for g-Values of ESR Centers in a-Si:H

H. Katagiri 1997

Author Index (Parts 1-4) 2003

Keyword Index (Parts 1-4) 2017