ISBN(softcover): 978-3-908450-64-1 ISBN(eBook): 978-3-0357-0707-6

Table of Contents

Preface

Silicon Wafer Requirements for ULSI Device Processing
F. Illuzzi 1

Orthogonal Defect Solutions for Silicon Crystal Growth and Wafer Processing
R.J. Falster 9

On the Mechanism of Defect Suppression in Nitrogen-Doped Silicon Single Crystals
W. von Ammon, R. Hölzl, J. Virbulis, E. Dornberger, R. Schmolke and D. Gräf 17

Diffusion Coefficient and Equilibrium Concentration of Point Defects in Silicon Crystals, Estimated via Grown-in Defect Behavior
K. Nakamura, T. Saishoji and J. Tomioka 25

The Effects of Impurities on Extended Defects in Cz Silicon Crystals Grown under Interstitial-Rich Conditions
K. Terashima and H. Noguchi 35

Modeling of Impurity Transport and Point Defect Formation during Cz Si Crystal Growth
V.V. Kalaev, V.A. Zabelin and Y. Makarov 41

Effect of Heavy Carbon, Nitrogen and Boron Doping on Oxygen Precipitation Behavior in Silicon Epitaxial Wafers
K. Sueoka, M. Akatsuka, M. Yonemura, T. Ono, E. Asayama, Y. Koike and S. Sadamitsu 49

Carbon-Oxygen-Related Complexes in Irradiated and Heat-Treated Silicon: IR Absorption Studies
L.I. Murin, V.P. Markevich, J.L. Lindström, M. Kleverman, J. Hermansson, T. Hallberg and B.G. Svensson 57

Infrared Absorption Analysis of Nitrogen in Czochralski Silicon
Y. Yamanaka, H. Harada, K. Tanahashi, T. Mikayama and N. Inoue 63

Role of Nitrogen-Related Complexes in the Formation of Defects in N-Cz Silicon Wafers
A. Karoui, F.S. Karoui, D.R. Yang and G.A. Rozgonyi 69

Optical Properties of Oxygen Agglomerates in Silicon
S. Binetti, S. Pizzini, E. Leoni, R. Somaschini, A. Castaldini and A. Cavallini 75

Positron Annihilation Studies of Oxygen Precipitation in Silicon and of Nano-Precipitates in Si-Rich SiO_2 Films: Role of Vacancy-Like Defects
R.S. Brusa, W. Deng, G.P. Karwasz and A. Zecca 81

Silicon Isotope Shifts of the 648-cm^{-1} Infrared Absorption Line of Oxygen in Silicon
H. Yamada-Kaneta 87

Thermal Donors in Silicon Implanted with Rare Earth Impurities
V.V. Emtsev, C.A.J. Ammerlaan, B.A. Andreev, G.A. Oganesyan, D.S. Poloskin, E.I. Shek and N.A. Sobolev 93

Interfacial Oxygen Thermodonor Formation in Plasma-Hydrogenated Silicon
G.N. Kamaev, V.V. Bolotov, S.A. Chern'aev and M.D. Efremov 99

Vibrational Modes of Oxygen Dimers in Germanium
V.V. Litvinov, L.I. Murin, J.L. Lindström, V.P. Markevich and A.A. Klechko 105

Oxygen Precipitation in Silicon Doped with Tin
L.I. Khirunenko, Y.V. Pomozov and M.G. Sosnin 111

Hydrostatic Pressure Effect on Redistribution of Oxygen Atoms in Oxygen-Implanted Silicon
A. Misiuk, A. Barcz, J. Ratajczak, I.V. Antonova and J. Jun 115

Elastic Instability of Strained Spherical Precipitates as a Cause of Oxide Platelets in Silicon
V.V. Voronkov and R.J. Falster 121

Impact of Hydrogen on Oxygen Precipitation and Gate Oxide Integrity after RTA Processing
T. Müller, G. Obermeier, T. Bearda, A. Huber, R. Schmolke, W. von Ammon and W. Lerch 127

Hydrogen Interaction with Transition Metals in Silicon, Studied by Electron Paramagnetic Resonance
P.T. Huy and C.A.J. Ammerlaan 133

Raman Spectroscopic Analysis of Hydrogen Plasma Treated Czochralski Silicon
R. Job, A.G. Ulyashin and W.R. Fahrner 139

Nitrogen Effect on Hydrogen Penetration into Cz Si during Wet Chemical Etching
A.L. Parakhonsky, E.B. Yakimov and D.R. Yang 145

Hydrogen-Related Defects in High-Resistivity Silicon
O.A. Soltanovich, O.V. Feklisova and E.B. Yakimov 150

Infra Red Absorption by Hydrogen-Passivated Cracks in Silicon
D.V. Kilanov, L.N. Safronov and V.P. Popov 155

Atomistic Study of Boron Clustering in Silicon
P. Alippi, P. Ruggerone and L. Colombo 163

Self-Interstitial Kinetics and Transient Phenomena in Si Crystals
A. La Magna, S. Coffa, S. Libertino, M. Strobel and L. Colombo 171

Dependence of the Transient Enhanced Diffusion, of B in Si, upon B Concentration and Ion Implanted Dose
S. Solmi, G. Mannino, M. Servidori, M. Bersani, L. Mancini, S. Milita, V. Privitera and M. Anderle 177

Interstitial Diffusion Influence upon Two-Dimensional Boron Profiles
F. Giannazzo, V. Raineri, V. Privitera and F. Priolo 183

Incorporation, Diffusion and Agglomeration of Carbon in Silicon
P. Lavéant, P. Werner, G. Gerth and U.M. Gösele 189

Suppression of Boron Transient Enhanced Diffusion by C Trapping
S. Mirabella, A. Coati, S. Scalese, D. De Salvador, S. Pulvirenti, G. Bisognin, E. Napolitani, A. Terrasi, M. Berti, A. Carnera, A.V. Drigo and F. Priolo 195

Thermal Evolution of Extrinsic Defects in Ion Implanted Silicon: Current Understanding and Modelling
F. Cristiano, B. Colombeau, C. Bonafos, A. Altibelli, G. Benassayag and A. Claverie 201

Room Temperature Point Defect Migration in Crystalline Si
S. Libertino and S. Coffa 207

Electrical Effects of Point Defect Clouds at Dislocations in Silicon, Studied by Deep Level Transient Spectroscopy
W. Schröter, V.V. Kveder and H. Hedemann 213

The Effect of Intrinsic Point Defects upon Dislocation Motion in Silicon
I.V. Peidous, K.V. Loiko, D.A. Simpson, W.R. Frensley and H.R. Huff 219

Stress-Induced Redistribution of Point Defects in Silicon Device Structures
K.V. Loiko, I.V. Peidous, T.E. Harrington and W.R. Frensley 225

Characterization of Interstitial-Related Bulk Defects in p^- Silicon Substrates by Epitaxial Deposition
R. Schmolke, W. Angelberger, W. von Ammon and H. Bender 231

Monitoring of Defects in Thermal Oxides during Electrical Stress
D. Caputo, F. Irrera and F. Palma 237

Formation of Shallow Donors in Stress-Annealed Silicon Implanted with High-Energy Ions
I.V. Antonova, E.P. Neustroev, A. Misiuk and V.A. Skuratov 243

A Study of the Conversion of the VO to the VO_2 Defect in Heat-Treated Silicon under Stress
C.A. Londos, M. Potsidou, A. Misiuk and I.V. Antonova 249

Passivation of Al/Si Interface by Chemical Treatment: Schottky Barrier Height and Plasma Etch Induced Defects
Z.E. Horváth, M. Ádám, P. Godio, G. Borionetti, I.A. Szabó, E. Gombia and V. Van Tuyen 255

Impact of Compressive Stress on the Formation of Thermal Donors in Heat-Treated Silicon
A. Misiuk, B.A. Andreev, V.V. Emtsev, C.A. Londos, G.A. Oganesyan and D.S. Poloskin 259

Helium Bubble Growth in Silicon: Ripening or Bubble Motion and Coalescence?
V.M. Vishnyakov, S.E. Donnelly, G. Carter, R.C. Birtcher and L. Haworth 267

Void Shrinkage during Thermal Oxidation of Silicon
V. Raineri, S. Giuffrida and E. Rimini 273

Gettering Induced by Helium Implantation: Application to a Device
F. Roqueta, D. Alquier, L. Ventura and B. López 279

Defects Created by Helium Implantation at Different Temperatures in Silicon
M. David, E. Oliviero, A. Ratchenkova, N.N. Gerasimenko, A. Declémy, J.F. Barbot, A. van Veen and M.F. Beaufort 285

Damage Evolution in Helium-Hydrogen Co-Implanted (100) Silicon
R. Tonini, F. Corni, C. Nobili, G. Ottaviani, F. Cazzaniga and G. Queirolo 291

Gold Gettering by H^+ or He^{++} Ion Implantation Induced Cavities and Defects in Cz Silicon Wafers
I. Périchaud, E.B. Yakimov, S. Martinuzzi and C. Dubois 297

Influence of Depth in Helium Desorption from Cavities Induced by ^3He Implantation in Silicon
R. Delamare, E. Ntsoenzok, F. Labohm and A. van Veen 303

Dopant Segregation on Cavities Induced by Helium Implantation: The Case of Boron and Phosphorus
F. Cayrel, D. Alquier, F. Roqueta, L. Ventura, C. Dubois, R. Jérisian and D. Mathiot 309

Hydrogen Redistribution and Void Formation in Hydrogen Plasma Treated Czochralski Silicon
A.G. Ulyashin, R. Job, W.R. Fahrner, D. Grambole and F. Herrmann 315

Precipitation Kinetics and Recombination Activity of Cu in Si in the Presence of Internal Gettering Sites
A.A. Istratov, R. Sachdeva, C. Flink, S. Balasubramanian and E.R. Weber 323

Iron Solubility in Boron-Doped Silicon and Fe Gettering Mechanism in p/p^+ Epitaxial Wafers
M.B. Shabani, Y. Shiina, S. Shimanuki and F.G. Kirscht 331

Copper-Defect and Copper-Impurity Interactions in Silicon
S.K. Estreicher, D. West and P. Ordejón 341

Efficiency of Intrinsic Gettering for Copper in Silicon
S. Isomae, H. Ishida, T. Itoga and K. Hozawa 349

Nickel Gettering in Silicon: Role of Oxygen
G. Regula, R. El Bouayadi, B. Pichaud and E. Ntsoenzok 355

Electrical Activity of Dislocations in Si Decorated by Ni
V.V. Kveder, W. Schröter, M. Seibt and A. Sattler 361

Comparison of Nickel and Iron Gettering in Cz Silicon Wafers
F.G. Kirscht, B. Orschel, S. Rouvimov and M. Shabani 367

Recombination Lifetimes of Iron-Contaminated Silicon Wafers: Characterization Using a Single Set of Capture Cross-Sections
M. Rommel, G. Zoth, M. Ullrich and H. Ryssel 373

Internal Gettering in Silicon: Experimental and Theoretical Studies Based on Fast and Slow Diffusing Metals
P. Geranzani, M. Pagani, C. Pello and G. Borionetti 381

The Realization of Uniform and Reliable Intrinsic Gettering in 200mm p- and p/p- Wafers for a Low Thermal Budget 0.18µm Advanced CMOS Logic Process
M.J. Binns, A. Banerjee, R. Wise, D.J. Myers and T.A. McKenna 387

Application of Gate Oxide Integrity to the Evaluation of the Efficiency of Internal and External Gettering Sites in Si Wafers
S.V. Koveshnikov, D. Beauchaine, Z.J. Radzimski, L. Ling and K.V. Ravi 393

Defect Engineering and Prevention of Impurity Gettering at $R_P/2$ in Ion-Implanted Silicon
R. Kögler, A. Peeva, J. Kaschny, W. Skorupa and H. Hutter 399

Gettering Technology Based on Porous Silicon
G. Lamedica, M. Balucani, A. Ferrari, V. Bondarenko, V. Yakovtseva and L. Dolgyi 405

Platinum Silicide Precipitate Formation During Phosphorus Diffusion Gettering in Silicon
M. Seibt, A. Döller, V.V. Kveder, A. Sattler and A. Zozime 411

Impact of a Cooling Process on the Dopant Activity of Platinum in Silicon
L. Ventura, B. Pichaud and F. Lanois 417

Radiation Defects and Carrier Lifetime in Tin-Doped n-Type Silicon
E. Simoen, C. Claeys, A. Kraitchinskii, M. Kras'ko, V.B. Neimash and L.I. Shpinar 425

Ultra Low-Level Ion Implantation Damage Detected by p-n Junctions Biased above Breakdown
E. Sciacca, S. Lombardo, D. Patti, D. Sanfillippo, C. Di Franco, M. Ghioni, F. Zappa, E. Rimini and S. Cova 431

Radiation-Induced Electronic Defect Levels in High-Resistivity Si Detectors
E.V. Monakhov, B.S. Avset, A. Hallén and B.G. Svensson 441

p-n Junction Leakage in Neutron-Irradiated Diodes Fabricated in Various Silicon Substrates
A. Czerwinski, E. Simoen, A. Poyai, C. Claeys and H. Ohyama 447

Radiation Damage in MOS Structures, Irradiated with High-Energy Heavy Ions and Fast Neutrons, with Regard to Charge DLTS and C-V Measurements
J. Staňo, V.A. Skuratov and M. Žiška 453

Study of the Effect of Carrier Cross-Sections, on the Leakage Current of Irradiated Silicon Detectors, using the Exchange Charge Model
S. Saramad and A. Moussavi-Zarandi 459

Radiation Damage in npn Si Transistors due to High-Temperature Gamma Ray and 1-MeV Electron Irradiation
H. Ohyama, T. Hirao, E. Simoen, C. Claeys, M. Nakabayashi and S. Onoda 465

Impact of High-Energy Particle Irradiation on Polycrystalline Silicon Films
M. Nakabayashi, H. Ohyama, E. Simoen, C. Claeys, K. Tanaka, K. Kobayashi and K. Miyahara 471

Proton Irradiation Effects on Standard and Oxygenated Silicon Diodes
D. Bisello, N. Bacchetta, A. Candelori, A. Kaminski, D. Pantano, R. Rando, I. Stavitski and J. Wyss 477

Existence of an Epitaxially Ordered Phase in the Buried Oxide of SIMOX Wafers
T. Shimura, T. Hosoi, K. Fukuda and M. Umeno 485

Hydrogen-Related Phenomena in SOI Fabricated by Using H^+-Ion Implantation
I.V. Antonova, D.V. Nikolaev, O.V. Naumova and V.P. Popov 491

Hydrogen-Induced Shallow Donors in Silicon and Silicon-on-Insulator Structures Formed by Hydrogen Slicing
V.P. Popov, D.V. Kilanov, I.V. Antonova, O.V. Naumova, A.P. Stepovik, V.T. Gromov and A. Misiuk 497

Properties of Silicon Film in a Silicon-on-Glass Structure
D.V. Kilanov, I.V. Antonova, L.N. Safronov, V.P. Popov, V.I. Obodnikov and E.V. Spesivtsev 503

Structural and Photoluminescence Properties of H^+ Ion-Implanted Silicon-on-Insulator Structures Formed by Hydrogen Slicing
I.E. Tyschenko, A.B. Talochkin, K.S. Zhuravlev, V.I. Obodnikov and V.P. Popov 509

Charge Relaxation at Oxygen-Enriched Silicon Grain Boundaries
A.K. Fedotov, A.V. Mazanik and A.G. Ulyashin 515

Characterization of SiC Grown on Si(111) by Supersonic C_{60} Beams
L. Aversa, R. Verucchi, G. Ciullo, A. Boschetti, L. Ferrari, P. Moras, M. Pedio, A. Pesci and S. Iannotta 523

Effects of Pulsed Electron Beam Annealing on Radiation Damage in N Doped a-SiC:H Films Deposited by PECVD
J. Huran, I. Hotový, J. Staňo, A.P. Kobzev and N.I. Balalykin 529

Cavities in He-Implanted SiC
J.F. Barbot, E. Oliviero, M. David, A. Declémy, C. Blanchard, M.F. Beaufort and A. van Veen 533

Study of Relaxed $Si_{0.7}Ge_{0.3}$ Buffers, Grown on Patterned Silicon Substrates, by Raman Spectroscopy
G. Wöhl, E. Kasper, M. Klose, T. Hackbarth, H.-. Herzog and H. Kibbel 539

On the Properties of Divacancies in $Si_{1-x}Ge_x$
L.I. Khirunenko, Y.V. Pomozov, M.G. Sosnin, N.V. Abrosimov and W. Schröder 545

Kinetics of Surface Processes and Mechanisms of Alloy Intermixing Near Interfaces in $Si(Ge)/Si_{1-x}Ge_x$ Structures Grown by Molecular Beam Epitaxy with Combined Sources
L.K. Orlov and N.L. Ivina 551

Influence of Ge Content on Electrical Properties: Sheet Resistance and Hall Mobility in Ion Beam Synthesized $Si_{1-x}Ge_x$ Alloy
C. Cerrina, A. Nejim, Y. Wang and P.L.F. Hemment 557

Defect-Related Current Instabilities in InAs/GaAs and AlGaAs/GaAs Structures?
Z.E. Horváth, S. Franchi, A. Bosacchi, P. Frigeri, E. Gombia, R. Mosca and V. Van Tuyen 565

Segregation of Mg Implanted into InAs: Influence of the Internal Elastic Stresses
O. Velichko, V.A. Dobrushkin, A.K. Fedotov and V.A. Tsurko 569

Defects in CdTe <Cl> Induced by Powerful Laser Radiation
D.V. Korbutyak, S.G. Krylyuk, I.M. Kupchak, V.G. Litovchenko, L. Fedorenko, A. Medvid and Y. Hatanaka 575

Phonon-Plasmon Interaction in Tunnelling GaAs/AlAs Superlattices Grown on (311) and (100) Substrates
M.D. Efremov, V.A. Volodin, V.A. Sachkov, V.V. Preobrazhenski, B.R. Semyagin, N.N. Ledentsov, V.M. Ustinov, D. Litvinov and D. Gerthsen 581

Radiation-Stimulated Ordering Effect in CdS Crystals
B. Pavlyk, B. Tsybulyak and O. Klochan 587

The Laser-Stimulated Modification of the Surfaces of Polycrystalline CdTe Layers
A. Baidullaeva, P.E. Mozol and A.I. Vlasenko 593

Electroluminescence of Si Quantum Dots in MOS Structures
A. Irrera, G. Franzò, F. Iacona, E.C. Moreira and F. Priolo 601

Blue-Green Photoluminescence from Silicon Dioxide Films Containing Ge^+ Nanocrystals Formed under Conditions of High Hydrostatic Pressure Annealing
I.E. Tyschenko, L. Rebohle, A.B. Talochkin, B.A. Kolesov, M. Voelskow, A. Misiuk and W. Skorupa 607

Silicon Nanoclusters in Thermal Oxide Films on Silicon
M.V. Zamoryanskaya and V.I. Sokolov 613

Luminescence from Si Nanocrystals and Er^{3+} Ions Embedded in Resonant Cavities
F. Iacona, G. Franzò, E.C. Moreira, D. Pacifici and F. Priolo 617

Temporal Characteristics of the Optical Storage Effect in Si:Er
M. Forcales, I.V. Bradley, J.-.R. Wells and T. Gregorkiewicz 623

Effect of Selective Doping on Photo- and Electroluminescence Efficiency in Si:Er Structures
M. Stepikhova, B. Andreev, V.D. Kuznetsov, Z.F. Krasil'nik, A. Soldatkin, V. Shmagin and M. Bresler 629

The Structure and Photoluminescence of Erbium-Doped Nanocrystalline Silicon Thin Films Produced by Reactive Magnetron Sputtering
M.F. Cerqueira, M. Losurdo, M.V. Stepikhova, O. Conde, M.M. Giangregorio, P. Pinto and J.A. Ferreira 637

Defect Engineering in the Technology of Light-Emitting Structures Based on Monocrystalline Si Implanted with Rare Earth Ions
N.A. Sobolev 645

Excitation Cross-Section of Erbium in Semiconductor Matrices under Optical Pumping
O.B. Gusev, M.S. Bresler, P.E. Pak, I.N. Yassievich, M. Forcales, N.Q. Vinh and T. Gregorkiewicz 651

Spectroscopic Characterisation of Erbium Impurity in Crystalline Silicon
C.A.J. Ammerlaan and I. de Maat-Gersdorf 657

Nanocrystal MOS Memories Obtained by LPCVD Deposition of Si Nanograins
M. Vulpio, C. Gerardi, S. Lombardo, G. Ammendola, I. Crupi, T. Rossetti, N. Nastasi, G. Mantarro and G. Nicotra 663

Memory Effects in Single-Electron Nanostructures
I. Crupi, S. Lombardo, C. Gerardi, G. Ammendola, M. Vulpio, E. Rimini and M. Melanotte 669

Nanocrystal MOS with Silicon-Rich Oxide
I. Crupi, S. Lombardo, C. Gerardi, B. Fazio, M. Vulpio, E. Rimini and M. Melanotte 675

Self-Orientation of Silicon Nanocrystals Created under Pulse Laser Impact in Stressed α-Si:H Films on Glass Substrates
M.D. Efremov, V.A. Volodin, V.V. Bolotov, A.V. Kretinin, A.K. Gutakovskii, L.I. Fedina and S.A. Kochubei 681

Nucleation of Nanostructures from Surface Defects on Silicon
V. Palermo and D. Jones 687

Crystalline Silicon for Solar Cells
M. Kittler and W. Koch 695

Measurement of the Normalized Recombination Strength of Dislocations in Multicrystalline Silicon Solar Cells
M. Rinio, S. Peters, M. Werner, A. Lawerenz and H.J. Möller 701

Oxygen Annealing Behavior in Multicrystalline Silicon
D.R. Yang and H.J. Möller 707

Three-Dimensional Emitter Based on Locally Enhanced Diffusion (TREBLE) Structure: Modeling and Formation
S. Bourdais, A. Slaoui, G. Beaucarne, J. Poortmans, E. Christoffel and A. Zerga 713

Effective Gettering Mechanisms in Solar Multicrystalline Materials
A.A. Efremov, A.A. Evtukh, N.I. Klyui, V.G. Litovchenko, V. Popov, Y. Rassamakin, A.V. Sarikov, C. Häßler and W. Koch 719

Strain Characterisation at the nm Scale of Deep Sub-Micron Devices by Convergent-Beam Electron Diffraction
A. Armigliato, R. Balboni, A. Benedetti, G.P. Carnevale, A.G. Cullis, S. Frabboni and D. Piccolo 727

Gate-Oxide Integrity Evaluation Using Non-Ideal Metal-Oxide-Silicon Capacitor Structures
T. Mchedlidze 735

Lock-In IR-Thermography – A Novel Tool for Material and Device Characterization
S. Huth, O. Breitenstein, A. Huber, D. Dantz, U. Lambert and F. Altmann 741

Characterisation of Surface and Near-Surface Regions in High-Purity Cz Si
A. Castaldini, D. Cavalcoli, A. Cavallini, T. Minarelli and E. Susi 747

A Technique for Delineating Defects in Silicon
L. Mule'Stagno 753

SEM Vision Periodic Defect Review and Characterization after Inter-Metal Dielectric Deposition
S. Ventola, J. Fort, F. La Spada and P. Maniscalco 759

Ellipsometric Study of Ion-Implantation Damage in Single-Crystal Silicon - An Advanced Optical Model
P. Petrik, O. Polgár, T. Lohner, M. Fried, N.Q. Khánh and J. Gyulai 765

Evaluation of Effective Carrier Lifetime in Epitaxial Silicon Layers
H. Väinölä, J. Storgårds, M. Yli-Koski and J. Sinkkonen 771

Spatial Distribution of Strain and Phases in Si Nano-Indentation Analysed by Raman Mapping
F. Demangeot, P. Puech, V. Paillard, V. Domnich and Y.G. Gogotsi 777

Structure and Stability of Thin Praseodymium Oxide Layers on Si(001)
H.J. Müssig, J. Dąbrowski, K. Ignatovich, J.P. Liu, V. Zavodinsky and H.J. Osten 783

Structural Investigations of Praseodymium Oxide Epitaxially Grown on Silicon
P. Zaumseil, E. Bugiel, J.P. Liu and H.J. Osten 789

1D-ACAR Studies of As-Grown Impurity Centers in Silicon
N.Y. Arutyunov and V.Y. Trashchakov 795

Characterization of Interfacial States at Silicon Bicrystals
G.N. Kamaev, S.V. Golod, E.M. Skok, A.K. Fedotov and A.V. Mazanik 801

Minority Carrier Diffusion Lengths in Silicon Doped Gallium Nitride Thin Films Measured by Electron Beam Induced Current
C. Grazzi, M. Albrecht, H.P. Strunk, Z. Bougrioua and I. Moerman 807