

Table of Contents

Preface	iv
 I. Keynote Address	
Design: New Material Challenge for Silicon ULSI L.C. Kimerling	1
 II. Silicon Materials	
Silicon Wafer Technology: The Challenges towards the Gigabit Era A.P. Mozer	9
Hydrogen Annealed Silicon Wafer S. Nadahara, H. Kubota and S. Samata	19
Formation of Microscopic Distribution of Grown-In Defects in Czochralski Silicon Crystal R. Habu, K. Kawakami and M. Hasebe	27
CZ Crystal Growth Development in Super Silicon Crystal Project H. Yamagishi, M. Kuramoto, Y. Shiraishi, M. Machida, K. Takano, N. Takase, T. Iida, J. Matsubara and K. Takada	37
 III. Gettering Techniques	
Gettering by Voids in Silicon: A Comparison with other Techniques V. Raineri	43
Gettering in Advanced Low Temperature Processes S. Sadamitsu, S. Ogushi, Y. Koike, N. Reilly, T. Nagashima, M. Sano and H. Tsuya	53
Metal Gettering by Defective Regions in Carbon-Implanted Silicon R. Kögler, J.R. Kaschny, R.A. Yankov, P. Werner, A.B. Danilin and W. Skorupa	63
Metallic Impurity Gettering in MeV Implanted Si O.V. Kononchuk, R.A. Brown, S.V. Koveshnikov, K.L. Beaman, F. Gonzalez and G.A. Rozgonyi	69
Influence of Size and Density of Oxygen Precipitates of Internal Gettering Efficiency of Iron in Czochralski-Grown Silicon H. Takahashi, H. Yamada-Kaneta and M. Suezawa	75
A Quantitative Method of Metal Impurities Depth Profiling for Gettering Evaluation in Silicon Wafers M.B. Shabani, T. Yoshimi, S. Okuuchi and A. Kaniava	81
Oxygen Gettering on Buried Layers at Post-Implantation Annealing of Hydrogen Implanted Czochralski Silicon R. Job, W.R. Fahrner, A.G. Ulyashin, Y.A. Bumay, A.I. Ivanov and L. Palmetschofer	91
Use of Gettering and Defect Induced Processes in Ultra-Thin Buried Oxide Synthesis V.G. Litovchenko, A.A. Efremov, B.N. Romanyuk, V.P. Melnik and C. Claeys	97
Interaction of Impurities and Dislocations in Silicon before and after External Gettering I. Périchaud and S. Martinuzzi	103
The Influence of Intrinsic Point Defects on Getter Formation in Silicon Wafers M.G. Mil'vidskii, V.V. Voronkov, K.L. Enisherlova and V.J. Reznick	109
Comparison of External Gettering Efficiency of Phosphorus Diffusion, Aluminium-Silicon Alloying and Helium Implantation in Silicon Wafers N. Gay and S. Martinuzzi	115
 IV. Oxygen in Silicon	
Effect of High Temperature Pre-Anneal on Oxygen Precipitates Nucleation Kinetics in Si R.J. Falster, M. Cornara, D. Gambaro, M. Olmo and M. Pagani	123

Vacancy-Assisted Oxygen Precipitation Phenomena in Si R.J. Falster, M. Pagani, D. Gambaro, M. Cornara, M. Olmo, G. Ferrero, P. Pichler and M. Jacob	129
Mechanism of Slip Dislocation Generation by Oxide Precipitates in Czochralski Silicon Wafers K. Sueoka, M. Akatsuka, H. Katahama and N. Adachi	137
State of Oxygen and Growth Conditions T.M. Tkacheva and G.N. Petrov	143
Analyzing Oxygen Precipitation Using the Surface Photovoltage Technique (SPV) P. Moens, W. Dobbelaere and T. Colpaert	149
Study of Oxygen Related Recombination Defects in Si by Temperature-Dependent Lifetime and EBIC Measurements E. Gaubas, J. Vanhellemont, E. Simoen, C. Claeys and W. Seifert	155
Oxygen Precipitate Nucleation Process in Silicon with Different Oxygen Concentration and Structural Perfection I.V. Antonova, A. Misiuk, V.P. Popov, A.E. Plotnikov and B. Surma	161
Initial Stage of Oxygen Precipitation in Silicon A. Korniylo, A. Maksymov, M. Pashkovski and I. Savytskii	167
Oxygen Precipitation in Silicon Thin Layers in the Presence of Carbon T.M. Tkacheva, G.N. Petrov, K.L. Enisherlova and T.F. Rusak	171
Heterogeneous Precipitation of Silicon Oxide in Silicon at Laser Induced Centres Y. Blums and A. Medvid	177
Diffusion and Precipitation of Oxygen in Silicon Doped with Germanium L.I. Khirunenko, Y.V. Pomozev, V.I. Shakhovtsov and V.V. Shumov	183
Low-Temperature Doping of P-Type Czochralski Silicon due to Hydrogen Plasma Enhanced Thermal Donor Formation A.G. Ulyashin, Y.A. Bumay, R. Job, G. Grabosch, D. Borchert, W.R. Fahrner and A.Y. Diduk	189

V. Erbium in Silicon

Erbium in Silicon: Problems and Challenges S. Binetti, M. Donghi, S. Pizzini, A. Castaldini, A. Cavallini, B. Fraboni and N.A. Sobolev	197
Thermal Donors in Silicon Doped with Erbium V.V. Emtsev, N.A. Sobolev, B.A. Andreev, D.S. Poloskin and E.I. Shek	207
Radiation Induced Defects InGaAs Photodiodes by 1-MeV Fast Neutrons H. Ohyama, E. Simoen, C. Claeys, J. Vanhellemont, T. Kudou, Y. Takami and H. Sunaga	213

VI. Radiation Effects in Semiconductors

Defect Engineering Radiation Tolerant Silicon Detectors B.C. MacEvoy and S.J. Watts	221
Microscopic Studies of Radiation Damage-Induced Defects Responsible for the Deterioration of High-Resistivity Silicon Detectors H. Feick and M. Moll	233
Lattice Defects in Si_{1-x}Ge_x Devices by Proton Irradiation and their Effect on Device Performance H. Ohyama, E. Simoen, C. Claeys, J. Vanhellemont, Y. Takami, H. Sunaga, J. Poortmans and M. Caymax	239
An IR Study of the Annealing Behaviour of A-Center in Silicon C.A. Londos, N.V. Sarlis and L.G. Fytros	245
Lifetime Considerations for High-Energy Proton Irradiated Si p-n Junction Diodes E. Simoen, J. Vanhellemont and C. Claeys	251
Defect Formation during Erbium Implantation and Subsequent Annealing of Si:Er N.A. Sobolev, A.M. Emel'yanov, Y.A. Kudryavtsev, R.N. Kyutt, M.I. Makovijchuk, Y.A. Nikolaev, E.O. Parshin, V.I. Sakharov, I.T. Serenkov, E.I. Shek and K.F. Shtel'makh	257
Alpha-Particle Irradiation Induced Defects in Metal-Oxide-Semiconductor Silicon Transistor B.P. Koman, R.R. Ivanochko and A.K. Shkolnyy	263

The Change of Au-ZnS and Au-CdS Diode Structure Parameters Caused by Low-Dose X-Ray Irradiation	
B. Pavlyk, Y. Horyn' and B. Tsybulyak	269

VII. Dislocations in Silicon

Critical Resolved Shear Stress for a Dislocation Loop Growth, Stability and Retrogrowth in Silicon: Application to the 16 MEG DRAM	
B. Leroy	275
Modification of the Recombination Activity of Dislocations in Silicon by Hydrogenation, Phosphorous Diffusion and Heat Treatments	
W. Seifert, K. Knobloch and M. Kittler	287
Influence of Electric Field-Enhanced Emission on Deep Level Transient Spectra of Bandlike Extended Defects: NiSi₂-Precipitates in Silicon	
H. Hedemann and W. Schröter	293
The Effect of Dislocation Dissociation on the g-Tensor of Holes in Dislocation Related 1D Energy Band in Si	
V.V. Kveder, A.I. Shalynin, E.A. Steinman and A.N. Izotov	299
Influence of the Surface Metal Spraying on the Dislocation Detachment Process in Silicon Crystals	
V.A. Makara, L.P. Steblenko and A.M. Kolomiyets	305
The Magnesium Related Luminescence in Silicon and its Quenching due to the Presence of Dislocations	
E.A. Steinman, H.S. Leipner and H.G. Grimmeiss	313
Deformation Interaction of Defects in Crystal: Concept of Evaluation	
M.D. Efremov	319

VIII. Defect Engineering

Yield Analysis of CMOS Ics	
D. Schmitt-Landsiedel	327
The Role of Grown-in Defects in Advanced Silicon Technology	
G. Kissinger, D. Gräf, J. Vanhellemont, U. Lambert and H. Richter	337
Point Defect and Microdefect Dynamics in Czochralski-Grown Silicon: Simulations and Analysis of Self-Consistent Models	
T. Sinno and R.A. Brown	343
Observation of Vacancy Enhancement during Rapid Thermal Annealing in Nitrogen	
M. Jacob, P. Pichler, H. Ryssel, R.J. Falster, M. Cornara, D. Gambaro, M. Olmo and M. Pagani	349
Strain and Gettering in Epitaxial Silicon Wafers	
F.G. Kirscht, M.B. Shabani, T. Yoshimi, S.B. Kim, B. Snegirev, C.M. Wang, L. Williamson, K. Takashima, P. Taylor and D. Lange	355
Strain in Silicon below Si₃N₄ Stripes, Comparison between SUPREM IV Calculation and TEM/CBED Measurements	
A. Armigliato, R. Balboni, S. Frabboni, A. Tixier, G.P. Carnevale, P. Colpani and A. Marmioli	365
Defects Produced in Silicon by Reactive Ion Etching	
H.B. Erzgräber, H.H. Richter, M.-. Aminpur, A. Wolff and K. Blum	371
Depth Dependence of Dislocation Loop Dissolution Kinetics in Ion Implanted Silicon	
M. Seibt, Y.L. Huang and B. Plikat	377
Hydrogen Stimulated Destruction of Fe-B Pairs in p-Si	
E.B. Yakimov and A.L. Parakhonsky	383
Differential Interference Contrast Microscopy of Defects in As-Grown and Annealed Si Wafers	
M.-. Trauwaert, J. Vanhellemont, U. Lambert, D. Gräf, K. Kenis, P.W. Mertens and M. Heyns	387
Effect of Stress Induced Defects on Electrical Properties of Czochralski Grown Silicon	
A. Misiuk, W. Jung, B. Surma, J. Jun and M. Rozental	393

IX. Advanced Semiconductor Materials and Devices

Planar Solidification of Multicrystalline Silicon for Photovoltaic Applications W. Koch, C. Häbeler, H.-. Höfs, A. Müller and I.A. Schwirtlich	401
Implementation of Low Thermal Budget Techniques to Si and SiGe MOSFET Device Processing M. Glück, J. Hersener, H.G. Umbach, J. Rappich and J. Stein	413
Ge Concentration Effect on the Dislocation Mobility in the Bulk SiGe Alloy Single Crystals Y.L. Iunin, V.I. Orlov, D.V. Dyachenko-Dekov, N.V. Abrosimov, S.N. Rossolenko and W. Schröder	419
On the Defect Structures in Te-Doped GaAs C. Frigeri, J.L. Weyher, J. Jiménez, P. Martín and S. Müller	425
Study of Surface Conduction Related Effects in GaAs MESFET's V.R. Balakrishnan, V. Kumar and S. Ghosh	431
Nitridation Effects in n-CdTe S. Gurumurthy, H.L. Bhat and V. Kumar	441

X. Semiconductor Material and Device Diagnostics

Formation of Grown-in Defects in CZ-Si Crystals M. Hasebe, K. Nakai, W. Ohashi, Y. Ikematsu, T. Mizutani and T. Iwasaki	449
X-Ray Diffractometry and Admittance Spectroscopy Investigation of Silicon Implanted at Low Energies with Oxygen, Argon, or Silicon P. Zaumseil and S. Kar	459
Peculiarities of Raman Spectra and Real Structure of $\text{Ge}_{1-x}\text{Si}_x$ Solid Solution B. Dietrich and L.K. Orlov	465
Computer Simulation of Impurity Diffusion in the Vicinity of Grain Boundaries (Modified Fisher Model) A.K. Fedotov, M. Chuiko, A. Rabyshko and S. Shumski	471
Improved Extraction of Si Substrate Parameters from Combined I-V and C-V Measurements on P-N Junction Diodes A. Czerwinski, E. Simoen, J. Vanhellemont, D. Tomaszewski, J. Gibki and A. Bakowski	477
An Experimental Study of Ion Beam and ECR Hydrogenation of Self-Ion Implantation Damage in Silicon by Admittance Spectroscopy and X-Ray Triple Crystal Diffractometry S. Kar, P. Zaumseil and S. Ashok	483
Positron Annihilation Rate and Broad Component of 1D-ACAR in Cz-Si and Fz-Si N.Y. Arutyunov	489
Capacitance Spectroscopy of Thin GaAs Layers Grown by Molecular Beam Epitaxy at Low Temperatures V.V. Chaldyshev, P.N. Brounikov, A.A. Suvorova, S.G. Konnikov, V.V. Preobrazhenski, M.A. Putyato and B.R. Semyagin	495
Raman Spectroscopy Investigation of Silicon Nanocrystals Formation in Silicon Nitride Films V.A. Volodin, M.D. Efremov and V.A. Gritsenko	501
Raman and HREM Observation of Oriented Silicon Nanocrystals Inside Amorphous Silicon Films on Glass Substrates M.D. Efremov, V.V. Bolotov, V.A. Volodin, L.I. Fedina, A.A. Gutakovskij and S.A. Kochubei	507
A Model of Coupled Diffusion of Impurity Atoms and Point Defects in the Vicinity of Semiconductor Interfaces and Grain Boundaries O. Velichko and A.K. Fedotov	513
New Possibility of Impurities Express Determination by Laser Element Spark-Analyzer (LESA) T.M. Tkacheva, G.N. Petrov and D.V. Vlasov	519
Analytical Modeling of the Gold Diffusion Induced Modification of the Forward Current through P-N Silicon Junctions F. Gaiseanu, M. Sachelarie, D. Sachelarie and J. Esteve	525