

Table of Contents

Preface

Committees

iv

Preface

vi

SiC Bulk Growth

Chapter 1

Progress and Limits of the Numerical Simulation of SiC Bulk and Epitaxy Growth Processes

M. Pons, E. Blanquet, J.M. Dedulle, M. Ucar, P.J. Wellmann, Ö. Danielsson, P. Ferret, L. Di Cioccio, F. Baillet, D. Chaussende and R. Madar

3

Growth of Large Diameter SiC Crystals by Advanced Physical Vapor Transport

T. Anderson, D.L. Barrett, J. Chen, É. Emorhokpor, A. Gupta, R.H. Hopkins, A.E. Souzis, C.D. Tanner, M. Yoganathan, I. Zwieback, W.J. Choyke, R.P. Devaty and F. Yan

9

Crystalline Quality Evaluation of 6H-SiC Bulk Crystals Grown from Si-Ti-C Ternary Solution

K. Kusunoki, K. Kamei, Y. Ueda, S. Naga, Y. Ito, M. Hasebe, T. Ujihara and K. Nakajima

13

Growth of 2 Inches 6H-SiC Single Crystals by Sublimation Method: The Comparison of α - and β -SiC Powders

S.H. Seo, J.S. Song, M.H. Oh and Y.Z. Wang

17

A Study of 6H-Seeded 4H-SiC Bulk Growth by PVT

E.Y. Tupitsyn, A. Arjunan, R.T. Bondokov, R.M. Kennedy and T.S. Sudarshan

21

Modified Physical Vapor Transport Growth of SiC - Control of Gas Phase Composition for Improved Process Conditions

P.J. Wellmann, T.L. Straubinger, P. Desperrier, R. Müller, U. Künecke, S.A. Sakwe, H. Schmitt, A. Winnacker, E. Blanquet, J.M. Dedulle and M. Pons

25

High Al-Doping of SiC Using a Modified PVT (M-PVT) Growth Set-Up

R. Müller, U. Künecke, R. Weingärtner, H. Schmitt, P. Desperrier and P.J. Wellmann

31

Growth of Undoped (Vanadium-Free) Semi-Insulating 6H-SiC Single Crystals

T. Anderson, D.L. Barrett, J. Chen, É. Emorhokpor, A. Gupta, R.H. Hopkins, A.E. Souzis, C.D. Tanner, M. Yoganathan and I. Zwieback

35

Effect of Nitrogen Doping on the Formation of Planar Defects in 4H-SiC

D. Siche, M. Albrecht, J. Doerschel, K. Irmscher, H.J. Rost, M. Rossberg and D. Schulz

39

Evolution Roots of Growth-Induced Polytype Domains in 6H-SiC Single Crystals

S.H. Seo, J.S. Song, M.H. Oh and Y.Z. Wang

43

SiC Crystal Growth by Sublimation Method with Modification of Crucible and Insulation Felt Design

J.K. Kim, K.R. Ku, D.J. Kim, S.P. Kim, W.J. Lee, B.C. Shin, G.H. Lee and I.S. Kim

47

SiC Epitaxy

Chapter 2

Numerical Analysis of Growth Condition on SiC-CVD in the Horizontal Hot-Wall Reactor

S.I. Nishizawa and M. Pons

53

Epitaxial Deposition of Silicon Carbide Films in a Horizontal Hot-Wall CVD Reactor

A. Veneroni, F. Omarini, M. Masi, S. Leone, M. Mauceri, G. Pistone and G. Abbondanza

57

SiC and III-Nitride Growth in Hot-Wall CVD Reactor

E. Janzén, P. Bergman, Ö. Danielsson, U. Forsberg, C. Hallin, J. Hassan, A. Henry, I.G. Ivanov, A. Kakanakova-Georgieva, P.O. Å. Persson and Q. Wahab

61

New Achievements on CVD Based Methods for SiC Epitaxial Growth

D. Crippa, G.L. Valente, A. Ruggiero, L. Neri, R. Reitano, L. Calcagno, G. Foti, M. Mauceri, S. Leone, G. Pistone, G. Abbondanza, G. Abbagnale, A. Veneroni, F. Omarini, L. Zamolo, M. Masi, F. Roccaforte, G. Giannazzo, S. Di Franco and F. La Via

67

Increased Growth Rate in a SiC CVD Reactor Using HCl as a Growth Additive

R.L. Myers-Ward, O. Kordina, Z. Shishkin, S.P. Rao, R. Everly and S.E. Sadow

73

High Growth Rate (up to 20 $\mu\text{m/h}$) SiC Epitaxy in a Horizontal Hot-Wall Reactor J. Zhang, J. Mazzola, C. Hoff, Y. Koshka and J.B. Casady	77
Homoepitaxial Growth of 4H-SiC Using CH_3Cl Carbon Precursor Y. Koshka, H.D. Lin, G. Melnychuck, M.S. Mazzola and J.L. Wyatt	81
Improved Surface Morphology and Background Doping Concentration in 4H-SiC(000-1) Epitaxial Growth by Hot-Wall CVD K. Wada, T. Kimoto, K. Nishikawa and H. Matsunami	85
4H-SiC Epitaxial Growth on SiC Substrates with Various Off-Angles H. Saitoh and T. Kimoto	89
2-Inch 4H-SiC Homoepitaxial Layer Grown on On-Axis C-Face Substrate by CVD Method K. Kojima, H. Okumura, S. Kuroda, K. Arai, A. Ohi and H. Akinaga	93
Investigation of Basal Plane Dislocations in the 4H-SiC Epilayers Grown on {0001} Substrates H. Tsuchida, T. Miyanagi, I. Kamata, T. Nakamura, K. Izumi, K. Nakayama, R. Ishii, K. Asano and Y. Sugawara	97
Epitaxial Growth and Characterisation of Phosphorus Doped SiC Using TBP as Precursor A. Henry and E. Janzén	101
Experimental Investigation and Simulation of Silicon Droplets Formation during SiC CVD Epitaxial Growth G. Melnychuck, Y. Koshka, M.S. Mazzola and J.L. Wyatt	105
Structural Improvement of Seeds for Bulk Crystal Growth by Using Hot-Wall CVD of 4H-SiC G. Wagner, D. Schulz and J. Doerschel	109
CVD Growth and Characterization of 4H-SiC Epitaxial Film on (11-20) As-Cut Substrates Z.H. Zhang, Y. Gao, A. Arjunan, E. Toupitsyn, P. Sadagopan, R.M. Kennedy and T.S. Sudarshan	113
Evaluation of p-Type Doping for (1,1,-2,0) Epitaxial Layers Grown on α-Cut (1,1,-2,0) 4H-SiC Substrates C. Blanc, M. Zielinski, V. Soulière, C. Sartel, S. Juillaguet, S. Contreras, J. Camassel and Y. Monteil	117
Aluminium Doping of 4H-SiC Grown with HexaMethylDiSilane C. Sartel, V. Soulière, M. Zielinski, Y. Monteil, J. Camassel and S. Rushworth	121
Is the Al Solubility Limit in SiC Temperature Dependent or not? C. Jacquier, G. Ferro, M. Zielinski, E.K. Polychroniadis, A. Andreadou, J. Camassel and Y. Monteil	125
Homoepitaxial Growth on 4H-SiC (03-38) Face by Sublimation Close Space Technique S. Yoneda, T. Furusho, H. Takagi, S. Ohta and S. Nishino	129
LPE of Silicon Carbide Using Diluted Si-Ge Flux O. Filip, B.M. Epelbaum, M. Bickermann and A. Winnacker	133
Large Area SiC Epitaxial Layer Growth in a Warm-Wall Planetary VPE Reactor A.A. Burk, M.J. O'Loughlin, M.J. Paisley, A.R. Powell, M.F. Brady, S.G. Müller and S.T. Allen	137
Epitaxial Growth of n-Type 4H-SiC on 3" Wafers for Power Devices B. Thomas and C. Hecht	141
Epitaxial Overgrowth of 4H-SiC for Devices with p-Buried Floating Junction Structure J. Nishio, C. Ota, T. Shinohe, K. Kojima and H. Okumura	147
Reduction of Stacking Faults in Fast Epitaxial Growth of 4H-SiC and its Impacts on High-Voltage Schottky Diodes H. Fujiwara, T. Kimoto, T. Tojo and H. Matsunami	151
Development of Epitaxial SiC Processes Suitable for Bipolar Power Devices J.J. Sumakeris, M.K. Das, S.Y. Ha, E. Hurt, K.G. Irvine, M.J. Paisley, M.J. O'Loughlin, J.W. Palmour, M. Skowronski, H. McD. Hobgood and C.H. Carter Jr.	155
Characteristics of Trench-Refilled 4H-SiC P-N Junction Diodes Fabricated by Selective Epitaxial Growth C.H. Li, P.A. Losee, J. Seiler, T.P. Chow and I. Bhat	159
Molecular Beam Epitaxy of Semiconductor Nanostructures Based on SiC A. Fissel	163
Computer Simulation of the Early Stages of Nano Scale SiC Growth on Si K.L. Safonov, Y.V. Trushin, O. Ambacher and J. Pezoldt	169
Growth of $3\text{C}-(\text{Si}_{1-x}\text{C}_{1-y})\text{Ge}_{x+y}$ Layers on 4H-SiC by Molecular Beam Epitaxy P. Weih, H. Romanus, T. Stauden, L. Spieß, O. Ambacher and J. Pezoldt	173

Lateral Epitaxial Overgrowth of 3C-SiC on Si Substrates by CVD Method S. Sugishita, A. Shoji, Y. Mukai, T. Nishiguchi, K. Michikami, T. Isshiki, S. Ohshima and S. Nishino	177
Suppression Mechanism of Double Positioning Growth in 3C-SiC(111) Crystal by Using an Off-Axis Si(110) Substrate M. Nakamura, T. Isshiki, T. Nishiguchi, K. Nishio, S. Ohshima and S. Nishino	181
Influence of Substrate Roughness on the Formation of Defects in 3C-SiC Grown on Si(110) Substrate by Hetero-Epitaxial CVD Method T. Isshiki, M. Nakamura, T. Nishiguchi, K. Nishio, S. Ohshima and S. Nishino	185
Planar Defects, Voids and their Relationship in 3C-SiC Layers D. Méndez, A. Aouni, D. Araújo, G. Ferro, Y. Monteil and E. Bustarret	189
Suppression of the Twin Formation in CVD Growth of (111) 3C-SiC on (110) Si Substrate T. Nishiguchi, M. Nakamura, K. Nishio, T. Isshiki, S. Ohshima and S. Nishino	193
Regrowth of 3C-SiC on CMP Treated 3C-SiC/Si Epitaxial Layers H. Mank, C. Moisson, D. Turover, M.E. Twigg and S.E. Sadow	197
Low Temperature Chemical Vapor Deposition of 3C-SiC on Si Substrates C. Förster, V. Cimalla, O. Ambacher and J. Pezoldt	201
Challenge to 200 mm 3C-SiC Wafers Using SOI M. Nakao, H. Iikawa, K. Izumi, T. Yokoyama and S. Kobayashi	205
Key Radicals for Hetero-Epitaxial Growth of 3C-SiC on Silicon Substrates H. Shimizu, K. Hisada and Y. Aoyama	209
Nucleation Control in FLASIC Assisted Short Time Liquid Phase Epitaxy by Melt Modification J. Pezoldt, E.K. Polychroniadis, T. Stauden, G. Ecke, T. Chassagne, P. Vennéguès, A. Leycuras, D. Panknin, J. Stoemenos and W. Skorupa	213
A Thermal Model for Flash Lamp Annealing of 3C-SiC/Si Multi-Layer Systems (i-FLASiC) M. Smith, R.A. McMahon, W. Skorupa, M. Voelskow and J. Stoemenos	217
Microstructures in the Pendeo Epitaxial Layer of 3C-SiC on Si Substrate A. Shoji, M. Nakamura, K. Mitikami, T. Isshiki, S. Ohshima and S. Nishino	221
Large Area DPB Free (111) β-SiC Thick Layer Grown on (0001) α-SiC Nominal Surfaces by the CF-PVT Method D. Chaussende, L. Latu-Romain, L. Auvray, M. Ucar, M. Pons and R. Madar	225
Comparative Evaluation of Free-Standing 3C-SiC Crystals E.K. Polychroniadis, C. Balloud, S. Juillaguet, G. Ferro, Y. Monteil, J. Camassel and J. Stoemenos	229
Epitaxial SiC Formation at the SiO₂/Si Interface by C⁺ Implantation into SiO₂ and Subsequent Annealing M. Voelskow, D. Panknin, E.K. Polychroniadis, G. Ferro, P. Godignon, N. Mestres, W. Skorupa, Y. Monteil and J. Stoemenos	233
Microfabrication of Si Column Covered with SiC Film for Electron Emitter T. Nakata, Y. Ohshiro, A. Shoji, Y. Okui, S. Ohshima, Y. Hayashi and S. Nishino	237
Formation of Ferromagnetic SiC:Mn Phases M. Syväjärvi, L. Nasi, G.R. Yazdi, G. Salvati, M. Izadifard, I.A. Buyanova, W.M. Chen and R. Yakimova	241
Two-Dimensional Model of Conjugate Heat and Mass Transport in the Isothermal Chemical Vapour Infiltration of 3D-Preform by SiC Matrix V.I. Kulik, A.V. Kulik, M.S. Ramm, A.S. Nilov and M.V. Bogdanov	245

Porous SiC

Chapter 3

A Short Synopsis of the Current Status of Porous SiC and GaN Y. Shishkin, Y. Ke, R.P. Devaty and W.J. Choyke	251
Preparation of Porous 4H-SiC by Surface Anodization Y. Chen, S. Shoji, S. Sugishita, S. Ohshima and S. Nishino	257
Optical Spectroscopy as a Tool for Observation of Porous SiC Graphitization V.B. Shuman and N.S. Savkina	261
X-Ray Diffraction Analysis of Epigrowth on Porous 4H-SiC Substrates I.L. Shulpina, N.S. Savkina, V.B. Shuman, V.V. Ratnikov, M. Syväjärvi and R. Yakimova	265

On Current Limitations in Porous SiC Applications	269
M.G. Mynbaeva, A. Lavrent'ev, I. Kotousova, A.N. Volkova, K. Mynbaev and A.A. Lebedev	
Interface Defects in n-Type 3C-SiC/SiO₂: An EPR Study of Oxidized Porous Silicon Carbide Single Crystals	273
H.J. von Bardeleben, J.L. Cantin, L. Ke, Y. Shishkin, R.P. Devaty and W.J. Choyke	
Modification of the Oxide/Semiconductor Interface by High Temperature NO Treatments: A Combined EPR, NRA and XPS Study on Oxidized Porous and Bulk n-Type 4H-SiC	277
H.J. von Bardeleben, J.L. Cantin, I. Vickridge, Y.W. Song, S. Dhar, L.C. Feldman, J.R. Williams, L. Ke, Y. Shishkin, R.P. Devaty and W.J. Choyke	

SiC Characterization

Chapter 4

Development of a KOH Defect Etching Furnace with Absolute In-Situ Temperature Measurement Capability	283
S.A. Sakwe, Z.G. Herro and P.J. Wellmann	
Characterization of SiC Thin Film Obtained by Magnetron Reactive Sputtering: IBA, IR and Raman Studies	287
H. Colder, M. Morales, R. Rizk and I. Vickridge	
RBS-Channeling and EPR Studies of Damage in 2 MeV Al²⁺-Implanted 6H-SiC Substrates	291
Y. Morilla, J. García López, G. Battistig, J.L. Cantin, J.C. Cheang-Wong, H.J. von Bardeleben and M.A. Respaldiza	
Microstructural Characterization of 3C-SiC Thin Films Grown by Flash Lamp Induced Liquid Phase Epitaxy	295
G. Ferro, D. Panknin, E.K. Polychroniadis, Y. Monteil, W. Skorupa and J. Stoemenos	
Dynamical Study of Dislocations and 4H → 3C Transformation Induced by Stress in (11-20) 4H-SiC	299
H. Idrissi, M. Lancin, J. Douin, G. Regula and B. Pichaud	
Pressure Effect on the Elastic Properties of SiC Polytypes	303
S.Y. Davydov	
[01-15] Grown 6H-SiC Bulk Crystals Investigated by High Energy Triple Axis X-Ray Diffraction	307
C. Seitz, Z.G. Herro, B.M. Epelbaum, A. Winnacker, R. Hock and A. Magerl	
XRDT Study of Structural Defects of 6H-SiC Crystals	311
G. Agrosi, R.A. Fregola, A. Monno, E. Scandale and G. Tempesta	
Defect Characterization of 4H-SiC Bulk Crystals Grown on Micropipe Filled Seed Crystals	315
T. Kato, K. Kojima, S.I. Nishizawa and K. Arai	
PVT-Growth and Characterization of Single Crystalline 3C-SiC on a (0001) 6H-SiC Substrate	319
E.K. Polychroniadis, A. Mantzari, A. Freudenberg, J. Wollweber, R. Nitschke, T. Frank, G. Pensl and A. Schöner	
Structure of In-Grown Stacking Faults in the 4H-SiC Epitaxial Layers	323
S. Izumi, H. Tsuchida, T. Tawara, I. Kamata and K. Izumi	
Investigation of Stacking Fault Formation in Hydrogen Bombarded 4H-SiC	327
A. Galeckas, H. K.-Nielsen, J. Linnros, A. Hallén, B.G. Svensson and P. Pirouz	
Intensity Ratio of the Doublet Signature of Excitons Bound to 3C-SiC Stacking Faults in a 4H-SiC Matrix	331
J. Camassel and S. Juillaguet	
Specific Aspects of Type II Heteropolytype Stacking Faults in SiC	335
S. Juillaguet and J. Camassel	
Optical Characterization of Deep Level Defects in SiC	341
B. Magnusson and E. Janzén	
Optical Centres with Local Vibrational Modes Created by High Temperature Annealing of Electron Irradiated 4H and 6H Silicon Carbide	347
J.W. Steeds, S.A. Furkert, W. Sullivan, J.M. Hayes and N.G. Wright	
Hyperfine Interaction of Nitrogen Donor in 4H-SiC Studied by Pulsed-ENDOR	351
N.T. Son, J. Isoya, S. Yamasaki and E. Janzén	
Midgap Levels in As-Grown 4H-SiC Epilayers Investigated by DLTS	355
K. Danno, T. Kimoto and H. Matsunami	

Electronic Levels Induced by Irradiation in 4H-Silicon Carbide A. Castaldini, A. Cavallini, L. Rigutti and F. Nava	359
Capacitance Spectroscopy Study of High Energy Electron Irradiated and Annealed 4H-SiC G. Alfieri, E.V. Monakhov, M.K. Linnarsson and B.G. Svensson	365
Recombination Enhanced Defect Annealing in 4H-SiC L. Storasta, F.H.C. Carlsson, P. Bergman and E. Janzén	369
Room Temperature Steady State and Time Resolved PL Characterization of Ion Irradiation Induced Defects in 6H-SiC R. Reitano, M. Zimbone, P. Musumeci and P. Baeri	373
Comparative Study of 4H-SiC Irradiated with Neutrons and Heavy Ions E.V. Kalinina, G. Kholuyanov, G. Onushkin, D.V. Davydov, A.M. Strel'chuk, A.O. Konstantinov, A. Hallén, V.A. Skuratov and A.Y. Kuznetsov	377
Optical-Capacitance-Transient Spectroscopy Study for Deep Levels in 4H-SiC Epilayer Grown by Cold Wall Chemical Vapor Deposition M. Kato, S.I. Tanaka, M. Ichimura, E. Arai, S. Nakamura and T. Kimoto	381
Direct Experimental Comparison of the Effects of Electron Irradiation on the Charge Carrier Removal Rate in n-Type Silicon and Silicon Carbide V.V. Kozlovski, E.V. Bogdanova, V.V. Emtsev, K.V. Emtsev, A.A. Lebedev and V.N. Lomasov	385
Study of Ion Induced Damage in 4H-SiC A. Lo Giudice, P. Oliveira, F. Fizzotti, C. Manfredotti, E. Vittone, S. Bianco, G. Bertuccio, R. Casiraghi and M. Jaksic	389
Micro-Optical Characterization Study of Highly p-Type Doped SiC:Al Wafers P.J. Wellmann, R. Müller, M. Pons, A. Thuair, A. Crisci, M. Mermoux and L. Auvray	393
Improved Resolution of Epitaxial Thin Film Doping Using FTIR Reflectance Spectroscopy M.S. Mazzola, S.G. Sunkari, J. Mazzola, H. Das, G. Melnychuck, Y. Koshka, J.L. Wyatt and J. Zhang	397
Electrical Properties of p-Type In-Situ Doped vs. Al-Implanted 4H-SiC J. Pernot, S. Contreras, J. Camassel and J. Robert	401
Characterization of 4H-SiC Epitaxial Layers by Microwave Photoconductivity Decay R.J. Kumar, P.A. Losee, C.H. Li, J. Seiler, I. Bhat, T.P. Chow, J.M. Borrego and R.J. Gutmann	405
Nonequilibrium Carrier Diffusion and Recombination in Heavily-Doped and Semi-Insulating Bulk HTCVD Grown 4H-SiC Crystals L. Storasta, R. Aleksiejūnas, M. Sūdžius, A. Kadys, T. Malinauskas, K. Jarašiūnas, B. Magnusson and E. Janzén	409
Optical Studies of Nonequilibrium Carrier Dynamics in Highly Excited 4H-SiC Epitaxial Layers K. Neimontas, R. Aleksiejūnas, M. Sūdžius, K. Jarašiūnas and P. Bergman	413
Comparison of Electrically and Optically Determined Minority Carrier Lifetimes in 6H-SiC S.A. Reshanov and G. Pensl	417
Electrical Characterisation of Heavily Al Doped 4H-SiC Layer Grown by Vapour-Liquid-Solid Epitaxy in Al-Si Melt P. Godignon, C. Jacquier, S. Blanqué, J. Montserrat, G. Ferro, S. Contreras, M. Zielinski and Y. Monteil	421
Evaluation of On-State Resistance and Boron-Related Levels in n-Type 4H-SiC R.R. Ciechonski, S. Porro, M. Syväjärvi and R. Yakimova	425
Effects of Epitaxial Layer Growth Parameters on the Defect Density and on the Electrical Characteristics of Schottky Diodes F. La Via, F. Roccaforte, S. Di Franco, A. Ruggiero, L. Neri, R. Reitano, L. Calcagno, G. Foti, M. Mauceri, S. Leone, G. Pistone, G. Abbondanza, G.L. Valente and D. Crippa	429
Infrared Gratings Based on SiC/Si-Heterostructures C. Rockstuhl, H.P. Herzig, C. Förster, A. Leycuras, O. Ambacher and J. Pezoldt	433
Characterisation of 4H-SiC PiN Diodes by Micro-Raman Scattering and Photoemission A. Thuair, M. Mermoux, A. Crisci, N. Camara, E. Bano, F. Baillet and E. Pernot	437
Hall Effect in the Channel of 3C-SiC MOSFETs M. Krieger, G. Pensl, M. Bakowski, A. Schöner, H. Nagasawa and M. Abe	441
Photoluminescence Study of In-Situ Rare Earth Doped PVT-Grown SiC Single Crystals H. Schmitt, R. Müller, M. Maier, A. Winnacker and P.J. Wellmann	445
Excitation Power Dependence of Al-Related Features in the LTPL Spectra of 4H-SiC M. Zielinski, C. Balloud, S. Juillaguet, B. Boyer, V. Soulière and J. Camassel	449

Concentration of N and P in SiC Investigated by Time-Of-Flight Secondary Ion Mass Spectrometry (TOF-SIMS)	
T. Acartürk, K. Semmelroth, G. Pensl, S.E. Saddow and U. Starke	453
Materials Characterization and Modeling of SiC in Europe - From the Viewpoint of a Theorist	
P. Deák	457
A New Model for the D₁-Luminescence in 6H-SiC	
E. Rauls, U. Gerstmann, M.V.B. Pinheiro, S. Greulich-Weber and J.M. Spaeth	465
Observation of Vacancy Clusters in HTCVD Grown SiC	
R. Aavikko, K. Saarinen, B. Magnusson and E. Janzén	469
Electron Irradiation Induced Vacancy Defects Detected by Positron Annihilation in 6H-SiC	
M.F. Barthe, L. Henry, S. Arpiainen and G. Blondiaux	473
The V_{Si}C_{Si}(Si_CC_{Si}) Complex in Electron-Irradiated 6H-SiC	
M.V.B. Pinheiro, E. Rauls, U. Gerstmann, S. Greulich-Weber and J.M. Spaeth	477
The Role of Nitrogen in the Annealing of Vacancies in 4H-SiC	
S. Dannefaer, V. Avalos and R. Yakimova	481
Defect Evolution in Ion Irradiated 6H-SiC Epitaxial Layers	
A. Ruggiero, M. Zimbone, F. Roccaforte, S. Libertino, F. La Via, R. Reitano and L. Calcagno	485
High-Temperature Stable Multi-Defect Clusters in Neutron Irradiated Silicon Carbide: Electron Paramagnetic Resonance Study	
P.G. Baranov, I.V. Ilyin, M.V. Muzafarova, E.N. Mokhov and S.G. Konnikov	489
Evolution of Defect and Hydrogen-Related Low Temperature Photoluminescence Spectra with Annealing for Hydrogen or Helium Implanted 6H SiC	
F. Yan, R.P. Devaty, W.J. Choyke, A. Gali, F. Schmid, G. Pensl and G. Wagner	493
M-Center in Low-Dose Proton Implanted 4H-SiC; Bistability and Change in Emission Rate	
H. K.-Nielsen, A. Hallén, D.M. Martin and B.G. Svensson	497
Ab Initio Calculation of Shallow Defects: Results for P-Related Donors in SiC	
U. Gerstmann, E. Rauls, H. Overhof and T. Frauenheim	501
Probing of the Wave Function of Shallow Donors and Acceptors by EPR in SiC Crystals with Changed Isotopic Composition	
M.V. Muzafarova, I.V. Ilyin, E.N. Mokhov, P.G. Baranov, B.Y. Ber, A.N. Ionov, P.S. Kop'ev, M.A. Kaliteevskii, O.N. Godisov and A.K. Kaliteevskii	507
Effective-Mass Theory of Shallow Donors in 4H-SiC	
I.G. Ivanov, A. Stelmach, M. Kleverman and E. Janzén	511
Electron Paramagnetic Resonance of Shallow Phosphorous Centers in 4H- and 6H-SiC	
N.T. Son, A. Henry, J. Isoya and E. Janzén	515
Theoretical Investigations of Complexes of p-Type Dopants and Carbon Interstitial in SiC: Bistable, Negative-U Defects	
A. Gali, T. Hornos, P. Deák, N.T. Son, E. Janzén and W.J. Choyke	519
Ab-Initio Study of Dopant Interstitials in 4H-SiC	
A. Mattausch, M. Bockstedte and O. Pankratov	523
Kinetic Aspects of the Interstitial-Mediated Boron Diffusion in SiC	
M. Bockstedte, A. Mattausch and O. Pankratov	527
3d-Transition Metals in Cubic and Hexagonal Silicon Carbide	
W.V.M. Machado, J.F. Justo and L.V.C. Assali	531
Hydrogen-Saturated SiC-Surfaces: Model Systems for Studies of Passivation, Reconstruction and Interface Formation	
T. Seyller	535
First Principles Simulations of SiC-Based Interfaces	
A. Catellani, G. Cicero, M.C. Righi and C.A. Pignedoli	541
Surface Band Structure Studies of Si Rich Reconstructions on 4H-SiC(1-100)	
K.V. Emtsev, T. Seyller, L. Ley, A. Tadich, L. Broekman, E. Huwald, J.D. Riley and R.C.G. Leckey	547
Electrical Characterization of Defects in p-Type SiC Using Recombination Induced Conductivity Inversion	
B. Krishnan and Y. Koshka	551
Analysis of SiC Islands Formation during First Steps of Si Carbonization Process	
D. Méndez, A. Aouni, D. Araújo, E. Bustarret, G. Ferro and Y. Monteil	555

ALD Deposited Al₂O₃ Films on 6H-SiC(0001) after Annealing in Hydrogen Atmosphere K.Y. Gao, T. Seyller, K.V. Emtsev, L. Ley, F. Ciobanu and G. Pensl	559
SiC/SiO₂ Interface States: Properties and Models V.V. Afanas'ev, F. Ciobanu, S. Dimitrijević, G. Pensl and A. Stesmans	563
The Search for Near Interface Oxide Traps - First-Principles Calculations on Intrinsic SiO₂ Defects J.M. Knaup, P. Deák, A. Gali, Z. Hajnal, T. Frauenheim and W.J. Choyke	569
Interface States in SiO₂/4H-SiC(0001) Interfaces from First-Principles: Effects of Si-Si Bonds and of Nitrogen Atom Termination T. Ohnuma, H. Tsuchida, T. Jikimoto, A. Miyashita and M. Yoshikawa	573
Structural and Electronic Properties of Si_{1-x}C_xO₂ J.F. Justo, C.R.S.d. Silva, I. Pereyra and L.V.C. Assali	577
Surface and Interface Studies of Si-Rich 4H-SiC and SiO₂ C. Virojanadara and L.I. Johansson	581
Characterization of Oxide Films on SiC Epitaxial (000-1) Faces by Angle-Resolved Photoemission Spectroscopy Measurements Using Synchrotron Radiation Y. Hijikata, H. Yaguchi, S. Yoshida, Y. Takata, K. Kobayashi, S. Shin, H. Nohira and T. Hattori	585
Characterization of SiC Passivation Using MOS Capacitor Ultraviolet-Induced Hysteresis K. Matocha, J.B. Tucker and E. Kaminsky	589
Observation of Deep Level Centers in 4H and 6H Silicon Carbide Metal Oxide Semiconductor Field Effect Transistors D.J. Meyer, M.S. Dautrich, P.M. Lenahan and A.J. Lelis	593

SiC Technology

Chapter 4

Technological Aspects of Ion Implantation in SiC Device Processes Y. Negoro, T. Kimoto and H. Matsunami	599
Fabrication of Compact Ion Implanter for Silicon Carbide Devices S. Mitani, S. Yamaguchi, S. Furukawa, T. Nakata, Y. Horino, R. Ono, Y. Hosokawa, M. Miyamoto and S. Nishino	605
Development of the Novel Electron Bombardment Anneal System (EBAS) for SiC Post Ion Implantation Anneal M. Shibagaki, Y. Kurematsu, F. Watanabe, S. Haga, K. Miura, T. Suzuki and M. Satoh	609
Aluminium Implantation Induced Linear Surface Faults in 4H-SiC N.G. Wright, K. Vassilevski, I.P. Nikitina, A.B. Horsfall, C.M. Johnson, P. Bhatnagar and P. Tappin	613
Electrical Behavior of Implanted Aluminum and Boron near Tail Region in 4H-SiC after High-Temperature Annealing Y. Negoro, T. Kimoto and H. Matsunami	617
Annealing of Aluminum Implanted 4H-SiC: Comparison of Furnace and Lamp Annealing M. Rambach, A.J. Bauer, L. Frey, P. Friedrichs and H. Ryssel	621
Ar Annealing at 1600°C and 1650°C of Al⁺ Implanted p⁺/n 4H-SiC Diodes: Analysis of the J-V Characteristics Versus Annealing Temperature F. Bergamini, F. Moscatelli, M. Canino, A. Poggi and R. Nipoti	625
J-V Characteristics of Al⁺ Ion Implanted p⁺/n 4H-SiC Diodes Annealed in Silane Ambient at 1600°C F. Bergamini, S.P. Rao, S.E. Sadow and R. Nipoti	629
P-Type SiC Layers Formed by VLS Induced Selective Epitaxial Growth M. Lazar, C. Jacquier, C. Dubois, C. Raynaud, G. Ferro, D. Planson, P. Brosselard, Y. Monteil and J. Chante	633
Ion Beam Analysis and Computer Simulation of Damage Accumulation in Nitrogen Implanted 6H-SiC: Effects of Channeling Z. Zolnai, A. Ster, N.Q. Khánh, E. Kótai, M. Posselt, G. Battistig, T. Lohner and J. Gyulai	637
Experimental Evidence for an Electrically Neutral (N-Si)-Complex Formed during the Annealing Process of Si⁺/N⁺-Co-Implanted 4H-SiC F. Schmid, T. Frank and G. Pensl	641

Homogeneity of Nitrogen and Phosphorus Co-Implants in 4H-SiC: Full Wafer Scale Investigation	
S. Blanqué, J. Lyonnet, J. Camassel, R. Pérez, P. Terziyska, S. Contreras, P. Godignon, N. Mestres and J. Pascual	645
n⁺/p Diodes Realized in SiC by Phosphorus Ion Implantation: Electrical Characterization as a Function of Temperature	
M. Canino, A. Castaldini, A. Cavallini, F. Moscatelli, R. Nipoti and A. Poggi	649
Study of Carbon in Thermal Oxide Formed on 4H-SiC by XPS	
P. Zhao, E. Rusli, J.H. Xia, C.M. Tan, Y. Liu, C.C. Tin, S.F. Yoon, W. Zhu and J. Ahn	653
The Role of Formation and Dissolution of C Clusters on the Oxygen Incorporation during Dry Thermal Oxidation of 6H-SiC	
C. Radtke, I.J.R. Baumvol, B.C. Ferrera and F.C. Stedile	657
Effects of Dislocations on Reliability of Thermal Oxides Grown on n-Type 4H-SiC Wafer	
J. Senzaki, K. Kojima, T. Kato, A. Shimozato and K. Fukuda	661
Competition between Oxidation and Recrystallization in Ion Amorphized (0001) 6H-SiC	
A. Poggi, A. Parisini, S. Solmi and R. Nipoti	665
High Temperature Rapid Thermal Oxidation and Nitridation of 4H-SiC in Diluted N₂O and NO Ambient	
R. Kosugi, K. Fukuda and K. Arai	669
4H-SiC MOS Structures Fabricated from RTCVD Si Layers Oxidized in Diluted N₂O	
A. Pérez-Tomás, D. Tournier, P. Godignon, N. Mestres and J. Millan	673
High-Reliability ONO Gate Dielectric for Power MOSFETs	
S. Tanimoto, H. Tanaka, T. Hayashi, Y. Shimoida, M. Hoshi and T. Mihara	677
An In-Situ Post Growth Annealing Process for the Improvement of 4H-SiC/SiO₂ MOS Interface Prepared by CVD Using TEOS, and its Characteristic Study	
K. Ramanujam, H. Furuichi, K. Taguchi, S. Yukumoto and S. Nishino	681
High Temperature NO Annealing of Deposited SiO₂ and SiON Films on N-Type 4H-SiC	
H. Yano, T. Hatayama, Y. Uraoka and T. Fuyuki	685
Characteristics of Post-Nitridation Rapid-Thermal Annealed Gate Oxide Grown on 4H-SiC	
K.Y. Cheong, W. Bahng and N.K. Kim	689
Low Density of Interface States in n-Type 4H-SiC MOS Capacitors Achieved by Nitrogen Implantation	
F. Ciobanu, G. Pensl, V.V. Afanas'ev and A. Schöner	693
Effects of N₂O Anneal on Channel Mobility of 4H-SiC MOSFET and Gate Oxide Reliability	
K. Fujihira, Y. Tarui, K. Ohtsuka, M. Imaizumi and T. Takami	697
Characterization of Aluminium and Titanium Oxides Deposited on 4H-SiC by Atomic Layer Deposition Technique	
M. Wolborski, M. Bakowski, V. Pore, M. Ritala, M. Leskelä, A. Schöner and A. Hallén	701
Electrical Properties of Aluminium Oxide Films Grown by Atomic Layer Deposition on n-Type 4H-SiC	
M. Avice, U. Grossner, E.V. Monakhov, J. Grillenberger, O. Nilsen, H. Fjellvåg and B.G. Svensson	705
Characterization of 4H-SiC MOS Structures with Al₂O₃ as Gate Dielectric	
A. Paskaleva, R.R. Ciechonski, M. Syväjärvi, E. Atanassova and R. Yakimova	709
4H-SiC MOSFETs Using Thermal Oxidized Ta₂Si Films as High-k Gate Dielectric	
A. Pérez-Tomás, P. Godignon, N. Mestres, J. Montserrat and J. Millan	713
Characterization of Polyimide Dielectric Layer for the Passivation of High Electric Field and High Temperature Silicon Carbide Power Devices	
S. Zemat, M.L. Locatelli and T. Lebey	717
Improvement in Electrical Performance of Schottky Contacts for High-Voltage Diode	
T. Nakamura, T. Miyagi, H. Tsuchida, I. Kamata, T. Jikimoto and K. Izumi	721
Surface Preparation of 6H-SiC Substrates by Electron Beam Annealing	
O.A. Agueev, S.P. Avdeev, A.M. Svetlichnyi, R.V. Konakova, V.V. Milenin, P.M. Lytvyn, O.S. Lytvyn, O.B. Okhrimenko, S.I. Soloviev and T.S. Sudarshan	725
Ion-Beam Induced Modifications of Titanium Schottky Barrier on 4H-SiC	
F. Roccaforte, F. Giannazzo, C. Bongiorno, S. Libertino, F. La Via and V. Raineri	729
Phase Formation at Rapid Thermal Annealing of Nickel Contacts on C-Face n-Type 4H-SiC	
S. Ferrero, A. Albonico, U.M. Meotto, G. Rambolà, S. Porro, F. Giorgis, D. Perrone, L. Scaltrito, E. Bontempi, L.E. Depero, G. Richieri and L. Merlin	733

Ni-Silicide Contacts to 6H-SiC: Contact Resistivity and Barrier Height on Ion Implanted n-Type and Barrier Height on p-Type Epilayer	737
F. Moscatelli, A. Scorzoni, A. Poggi, M. Canino and R. Nipoti	
Nucleation and Reaction of Ag on 4H-SiC(0001)	741
S. Soubatch and U. Starke	
Characterization of Electrical Contacts on Polycrystalline 3C-SiC Thin Films	745
A. Castaldini, A. Cavallini, M. Rossi, M. Cocuzza and C. Ricciardi	
Effect of the Metal Composition on the Electrical and Thermal Properties of Au/Pd/Ti/Pd Contacts to p-Type SiC	749
L. Kolaklieva, R. Kakanakov, T. Marinova and G. Lepoeva	
Step Structures Produced by Hydrogen Etching of Initially Step-Free (0001) 4H-SiC Mesas	753
J.A. Powell, P.G. Neudeck, A.J. Trunek and P.B. Abel	
Reduction of Fluoride Species and Surface Roughness by H₂ Gas Addition in SiC Dry Etching	757
H. Mikami, Y. Horie, T. Hatayama, H. Yano, Y. Uraoka and T. Fuyuki	
Structure and Morphology of 4H-SiC Wafer Surfaces after H₂-Etching	761
S. Soubatch, S.E. Sadow, S.P. Rao, W.Y. Lee, M. Konuma and U. Starke	
Reactive Ion Etching Induced Surface Damage of Silicon Carbide	765
J.H. Xia, E. Rusli, R. Gopalakrishnan, S.F. Choy, C.C. Tin, J. Ahn and S.F. Yoon	
The Reactive Neutral Beam Etching of SiC and its Application in p-n Junction Periphery Protection	769
G. Sarov, T. Cholakova and R. Kakanakov	
Forward-Bias Degradation in 4H-SiC p⁺nn⁺ Diodes: Influence of the Mesa Etching	773
N. Camara, A. Thuair, E. Bano and K. Zekentes	
Trench Formation on Ion Implanted SiC Surfaces after Thermal Oxidation	777
W. Bahng, G.H. Song, N.K. Kim, S.C. Kim, H.W. Kim, K.S. Seo and E.D. Kim	
Metal Bonding in SiC Based Substrates	781
I. Matko, B. Chenevier, R. Madar, H. Roussel, S. Coindeau, F. Letertre, C. Richtarch and L. Di Cioccio	
SiC Power Device Packaging Technologies for 300 to 350°C Applications	785
R.W. Johnson and J.R. Williams	

SiC Devices

Chapter 6

Numerical Simulation and Optimization for 900V 4H-SiC DiMOSFET Fabrication	793
S.C. Kim, W. Bahng, N.K. Kim, E.D. Kim, T. Ayalew, T. Grasser and S. Selberherr	
4H-SiC DMOSFETs for High Speed Switching Applications	797
S.H. Ryu, S. Krishnaswami, M.K. Das, J. Richmond, A.K. Agarwal, J.W. Palmour and J.D. Scofield	
Realisation of Large Area 3C-SiC MOSFETs	801
A. Schöner, M. Bakowski, P. Ericsson, H. Strömberg, H. Nagasawa and M. Abe	
4H-SiC Lateral RESURF MOSFETs on Carbon-Face Substrates	805
M. Okamoto, S. Suzuki, M. Kato, T. Yatsuo and K. Fukuda	
Dose Designing for High-Voltage 4H-SiC RESURF MOSFETs - Device Simulation and Fabrication	809
H. Kawano, T. Kimoto, J. Suda and H. Matsunami	
Analysis of Low On-Resistance in 4H-SiC Double-Epitaxial MOSFET	813
S. Harada, M. Okamoto, T. Yatsuo, K. Fukuda and K. Arai	
Low On-Resistance in Normally-Off 4H-SiC Accumulation MOSFET	817
E. Okuno, T. Endo, H. Matsuki, T. Sakakibara and H. Tanaka	
Short-Channel Effects in 4H-SiC MOSFETs	821
M. Noborio, Y. Kanzaki, J. Suda, T. Kimoto and H. Matsunami	
Performance of SiC Cascode Switches with Si MOS Gate	825
G. Brezeanu, C. Boianceanu, M. Brezeanu, A. Mihaila, F. Udrea and G. Amaratunga	
Investigation of Degradation of Inversion Channel Mobility of SiC MOSFET due to the Increase of Channel Doping	829
T. Hatakeyama, T. Watanabe, J. Senzaki, M. Kato, K. Fukuda, T. Shinohe and K. Arai	

Field Effect Mobility in n-Channel Si Face 4H-SiC MOSFET with Gate Oxide Grown on Aluminium Ion-Implanted Material G. Gudjónsson, H.Ö. Ólafsson, F. Allerstam, P.Å. Nilsson, E.Ö. Sveinbjörnsson, T. Rödle and R. Jos	833
High Field Effect Mobility in 6H-SiC MOSFET with Gate Oxides Grown in Alumina Environment F. Allerstam, G. Gudjónsson, H.Ö. Ólafsson, E.Ö. Sveinbjörnsson, T. Rödle and R. Jos	837
High Field Effect Mobility in Si Face 4H-SiC MOSFET Made on Sublimation Grown Epitaxial Material E.Ö. Sveinbjörnsson, H.Ö. Ólafsson, G. Gudjónsson, F. Allerstam, P.Å. Nilsson, M. Syväjärvi, R. Yakimova, C. Hallin, T. Rödle and R. Jos	841
Modeling of Lattice Site-Dependent Incomplete Ionization in α-SiC Devices T. Ayalew, T. Grasser, H. Kosina and S. Selberherr	845
Physical Simulation of Drain-Induced Barrier Lowering Effect in SiC MESFETs C.L. Zhu, E. Rusli, J. Almira, C.C. Tin, S.F. Yoon and J. Ahn	849
High Power Lateral Epitaxy MESFET Technology in Silicon Carbide A.O. Konstantinov, C.I. Harris and I.C. Ray	853
Broadband RF SiC MESFET Power Amplifiers R. Jonsson and S. Rudner	857
Important Role of Parasitic Regions in Electrical Characteristics of SiC MESFETs H.Y. Cha, Y.C. Choi, L.F. Eastman, M.G. Spencer, L. Ardaravičius, A. Matulionis and O. Kiprijanovič	861
Hole-Like Defects in n-Channel 4H-SiC MESFETs Observed by Current Transient Spectroscopy J.M. Bluet, M. Gassoumi, I. Dermoul, F. Chekir, H. Maaref, G. Guillot, E. Morvan, C. Dua and C. Brylinski	865
High-Purity Versus High-Defect-Density Semiinsulating Substrates for SiC MESFET: Simulation of Device Characteristics Y. Koshka and I. Sankin	869
Wannier-Stark Localization Effects in 6H-SiC JFETs V.I. Sankin, P.P. Shkrebiy and A.A. Lebedev	873
Effective Edge Termination Design in SiC VJFET P. Bhatnagar, A.B. Horsfall, N.G. Wright, A.G. O'Neill, K. Vassilevski and C.M. Johnson	877
Electrical Characteristics Temperature Dependence of 600V-Class Deep Implanted Gate Vertical JFET M. Mizukami, O. Takikawa, S. Imai, K. Kinoshita, T. Hatakeyama, T. Domon and T. Shinohe	881
Gamma and Proton Irradiation Effects on 4H-SiC Depletion-Mode Trench JFETs J.N. Merrett, J.R. Williams, J.D. Cressler, A.P. Sutton, L. Cheng, V. Bondarenko, I. Sankin, D. Seale, M.S. Mazzola, B. Krishnan, Y. Koshka and J.B. Casady	885
Current Gain of 4H-SiC Bipolar Transistors Including the Effect of Interface States M. Domeij, E. Danielsson, H.S. Lee, C. Zetterling and M. Östling	889
BV_{CEO} Versus BV_{CBO} for 4H and 6H Polytype SiC Bipolar Junction Transistors S. Balachandran, T.P. Chow, A.K. Agarwal, S. Scozzie and K.A. Jones	893
Electrical Characteristics of 4H-SiC BJTs at Elevated Temperatures H.S. Lee, M. Domeij, E. Danielsson, C. Zetterling and M. Östling	897
1000 V, 30 A SiC Bipolar Junction Transistors and Integrated Darlington Pairs S. Krishnaswami, A.K. Agarwal, C. Capell, J. Richmond, S.H. Ryu, J.W. Palmour, S. Balachandran, T.P. Chow, S. Baynes, B. Geil, K.A. Jones and C. Scozzie	901
A 4H-SiC BJT with an Epitaxially Regrown Extrinsic Base Layer E. Danielsson, M. Domeij, H.S. Lee, C. Zetterling, M. Östling, A. Schöner and C. Hallin	905
Low and High Temperature Performance of 600V 4H-SiC Epitaxial Emitter BJTs S. Balachandran, T.P. Chow and A.K. Agarwal	909
Optimisation of Heterostructure Bipolar Transistors in SiC C.C. Chen, A.B. Horsfall, N.G. Wright and A.G. O'Neill	913
Comparison of High-Voltage 4H-SiC Insulated-Gate Bipolar Transistor (IGBT) and MOS-Gated Bipolar Transistor (MGT) L. Zhu, S. Balachandran and T.P. Chow	917

Process and Device Simulation of a SiC Floating Junction Schottky Barrier Diode (Super-SBD)	
T. Hatakeyama, J. Nishio and T. Shinohe	921
Influence of Overgrown Micropipes in the Active Area of SiC Schottky Diodes on Long Term Reliability	
R. Rupp, M. Treu, P. Türkes, H. Beermann, T. Scherg, H. Preis and H. Cerva	925
Temperature Impact on High-Current 1.2kV SiC Schottky Rectifiers	
X. Jordá, D. Tournier, J. Rebollo, J. Millan and P. Godignon	929
Temperature Stability of Breakdown Voltage on SiC Power Schottky Diodes with Different Barrier Heights	
R. Pierobon, G. Meneghesso, E. Zanoni, F. Roccaforte, F. La Via and V. Raineri	933
Planar Schottky Microwave Diodes on 4H-SiC	
M. Südwow, N. Rorsman, P.Å. Nilsson and H. Zirath	937
Design, Fabrication and Characterization of 1.5 mΩcm², 800 V 4H-SiC n-Type Schottky Barrier Diodes	
M. Furno, F. Bonani, G. Ghione, S. Ferrero, S. Porro, P. Mandracci, L. Scaltrito, G. Richieri, D. Perrone and L. Merlin	941
Temperature Dependence of 4H-SiC JBS and Schottky Diodes after High Temperature Treatment of Contact Metal	
R. Pérez, N. Mestres, D. Tournier, X. Jordá, P. Godignon and M. Vellvehi	945
Numerical Analysis of SiC Merged PiN Schottky Diodes	
T. Ayalew, S.C. Kim, T. Grasser and S. Selberherr	949
New High-Voltage Unipolar Mode p⁺ Si/n⁻ 4H-SiC Heterojunction Diode	
T. Hayashi, H. Tanaka, Y. Shimoida, S. Tanimoto and M. Hoshi	953
SiC Super Junction Power Devices: Modeling and Analysis	
Z.J. Shen, X. Cheng, B.S. Kang, K. So and I. Hsieh	957
Electrical Characteristics and Reliability of 4H-SiC PiN Diodes Fabricated on In-House Grown and Commercial Epitaxial Films	
P.A. Losee, C.H. Li, J. Seiler, R.E. Stahlbush, T.P. Chow, I. Bhat and R.J. Gutmann	961
Drift-Free, 50 A, 10 kV 4H-SiC PiN Diodes with Improved Device Yields	
M.K. Das, J.J. Sumakeris, B.A. Hull, J. Richmond, S. Krishnaswami and A.R. Powell	965
8.3 kV 4H-SiC PiN Diode on (000-1) C-Face with Small Forward Voltage Degradation	
K. Nakayama, Y. Sugawara, H. Tsuchida, T. Miyanagi, I. Kamata, T. Nakamura, K. Asano and R. Ishii	969
Steady-State and Transient Characteristics of High-Voltage 4H-SiC Junction Diodes	
P.A. Ivanov, M.E. Levinshtein, T.T. Mnatsakanov, J.W. Palmour, R. Singh, K.G. Irvine and M.K. Das	973
Large Area, Avalanche-Stable 4H-SiC PiN Diodes with V_{BR}	
D. Peters, R. Elpelt, R. Schörner, K.O. Dohnke, P. Friedrichs and D. Stephani	977
Demonstration of High-Power X-Band Oscillation in p⁺/n⁻/n⁺ 4H-SiC IMPATT Diodes with Guard-Ring Termination	
S. Ono, M. Arai and C. Kimura	981
Lifetime Control of the Minority Carrier in PiN Diodes by He⁺ Ion Implantation	
Y. Tanaka, K. Kojima, K. Takao, M. Okamoto, M. Kawasaki, A. Takatsuka, T. Yatsuo and K. Arai	985
Study of Forward Voltage Drift in Diffused SiC PiN Diodes Doped by Al or B	
S.I. Maximenko, S.I. Soloviev, A.E. Grekov, A.V. Bolotnikov, Y. Gao and T.S. Sudarshan	989
Influence of Gamma-Ray and Neutron Irradiation on Injection Characteristics of 4H-SiC pn Structures	
A.M. Strel'chuk, E.V. Kalinina, A.O. Konstantinov and A. Hallén	993
Investigation of Microwave Switching 4HSiC pin Diodes in the 20-500 °C Temperature Range	
M.S. Boltovets, V.V. Basanets, N. Camara, V.A. Krivutsa and K. Zekentes	997
Influence of Irradiation on Excess Currents in SiC pn Structures	
A.M. Strel'chuk, V.V. Kozlovski, A.A. Lebedev and N.Y. Smirnova	1001
A 3.5 kV Thyristor in 4H-SiC with a JTE Periphery	
P. Brosselard, T. Bouchet, D. Planson, S. Scharnholtz, G. Pâques, M. Lazar, C. Raynaud, J. Chante and E. Spahn	1005

SiC Materials and Technologies for Sensors Development P. Godignon	1009
Silicon Carbide for Alpha, Beta, Ion and Soft X-Ray High Performance Detectors G. Bertuccio, S. Binetti, S. Caccia, R. Casiraghi, A. Castaldini, A. Cavallini, C. Lanzieri, F. Nava, A. Le Donne, S. Pizzini, L. Rigutti and G. Verzellesi	1015
Measurements of Charge Collection Efficiency of p⁺/n Junction SiC Detectors F. Moscatelli, A. Scorzoni, A. Poggi, M. Bruzzi, S. Lagomarsino, S. Mersi, S. Sciortino, M. Lazar, A. Di Placido and R. Nipoti	1021
Investigation of the SiC Transistor and Diode Nuclear Detectors at 8 MeV Proton Irradiation N.B. Strokan, A.M. Ivanov, N.S. Savkina, A.A. Lebedev, V.V. Kozlovski, M. Syväjärvi and R. Yakimova	1025
High Energy Resolution Detectors Based on 4H-SiC A.M. Ivanov, E.V. Kalinina, G. Kholuyanov, N.B. Strokan, G. Onushkin, A.O. Konstantinov, A. Hallén and A.Y. Kuznetsov	1029
High Temperature Hydrocarbon Sensing with Pt-Thin Ga₂O₃-SiC Diodes A. Trinchì, W. Włodarski, G. Faglia, A. Ponzoni, E. Comini and G. Sberveglieri	1033

Nitrides and Related Materials

Chapter 7

Modeling of Photon Recycling in GaN-Devices E. Velme, A. Udal and M. Klopov	1039
Nickel-Vacancy Complexes in Diamond: An Ab-Initio Investigation L.V.C. Assali, R. Larico, W.V.M. Machado and J.F. Justo	1043
Manganese Impurity in Boron Nitride and Gallium Nitride L.V.C. Assali, W.V.M. Machado and J.F. Justo	1047
Heteroepitaxy of GaN on Silicon: In Situ Measurements A. Krost, A. Dadgar, F. Schulze, R. Clos, K. Haberland and T. Zettler	1051
Structure and Energy of the 90° Partial Dislocations in Wurtzite-GaN G. Savini, M.I. Heggie, C.P. Ewels, N. Martsinovich, R. Jones and A.T. Blumenau	1057
High Temperature Contacts to GaN and SiC Based on TiB_x Nanostructure Layers M.S. Boltovets, V.N. Ivanov, A.Y. Avksentyev, A.E. Belyaev, A.G. Borisenko, O.A. Fedorovitch, R.V. Konakova, Y.Y. Kudryk, P.M. Lytvyn, V.V. Milenin, A.V. Sachenko and Y.N. Sveschnikov	1061
Microscopic Spatial Distribution of Bound Excitons in High-Quality ZnO F. Bertram, D. Forster, J. Christen, N. Oleynik, A. Dadgar and A. Krost	1065