

Curriculum vitae: Mladen PETRAVIĆ, MSc Zagreb, PhD ANU, FAIP

Date of Birth: 06/02/56, Zagreb, Croatia

Nationality: Croatian

Citizenship: Croatian and Australian

Highest Academic Qualification:

1993. PhD, Australian National University (ANU), Canberra, Australia
(Thesis title: "SIMS and ESD Studies of Semiconductor Structures")

Main Research Interests:

- ion beam analysis, characterisation and modifications of semiconductor materials
- SIMS, fundamentals and applications
- atomic collisions, sputtering and ionisation processes, phase transitions in solids
- photoemission, photoabsorption and photo desorption from semiconductor surfaces
- laser postionisation spectrometry (including the use of free electron lasers)
- synchrotron-based soft X-ray spectroscopies from semiconductor surfaces
- XPS from solid surfaces

Present Appointments:

- Professor of Physics, Department of Physics, University of Rijeka, Croatia
- Head of Division of Experimental and Applied Physics, Department of Physics, University of Rijeka, Croatia
- Deputy Head, Center for Micro and Nano Sciences and Technologies, University of Rijeka, Croatia
- Visiting Fellow, Department of Electronic Materials Engineering, Research School of Physics and Engineering, Australian National University, Canberra, Australia

Previous Appointments:

- 2006-2008: Department of Physics, Faculty of Arts and Sciences, University of Rijeka, Croatia
- 1989-2006: Department of Electronic Materials Engineering, Australian National University, Canberra, Australia
- 2002-2005: Materials Science Division, Argonne National Laboratory, USA
- 1982-1989: Institute of Physics, University of Zagreb, Croatia

Academic Awards:

- 1989: Commonwealth Postgraduate Research Award, Australia
- 1991: Australian Postgraduate Research Award, Australia
- 1992: Australian Research Council Postdoctoral Fellowship, Australia

Membership of Professional Institutes:

- Fellow, Australian Institute of Physics
- Member, Vacuum Society of Australia
- Member, Croatian Physical Society

Record of Activity

A short statement on most significant contributions to the research field

My main research achievements have been in field of ion-solid interactions and the use of energetic ions, electrons and photons in modification and characterisation of semiconductor surfaces. I am best known internationally for substantial research contributions in Secondary Ion Mass Spectrometry. In 1993 I initiated, for the first time in Australia, a project on electron stimulated desorption from semiconductor surfaces, while in 1996 I started several projects on photon stimulated desorption from semiconductors using synchrotron radiation.

I have been involved in design and construction of a unique type of Laser Positioning Secondary Neutral Mass Spectrometer, which has been attached to the vacuum ultra-violet free electron laser built at the Advanced Photon Source of Argonne National Laboratory in Chicago.

My research has produced more than 100 papers in the prime international journals and has been internationally recognised by attracting 11 invitations to deliver plenary, key or invited lectures at international conferences and workshops.

Some highlights of my previous work include:

- A model for atomic mixing and profile broadening developed for low energy oxygen bombardment of Si and GaAs and the role of thermodynamic driving force and/or electric field in segregation/antisegregation of different impurities in Si under oxygen and nitrogen bombardment.
- The first demonstration of gettering of metals to cavities in Si formed by hydrogen implantation;
- Model for the formation of positive ions of elements with high ionisation potential during sputtering process;
- The first observation of interstitial molecular nitrogen in GaN bombarded by low-energy Ar ions and observation and explanation of band-bending in hydrogenated and ion-bombarded semiconductor compounds, studied with synchrotron-based spectroscopies;
- Pioneering the surface analysis of atoms and molecules from semiconductor surfaces with unprecedented sensitivity using VUV light from a free electron laser;
- Comprehensive study and explanation of ion-beam induced oxidation and nitridation of silicon;
- Observation and modeling of desorption of positive and negative ions from semiconductor surfaces under electron and photon bombardment, including i) desorption of multiply charged ions, ii) resonant-like desorption of negative ions under electron bombardment at core-level binding energies, iii) photon stimulated desorption and the selective removal of hydrogen from hydrogenated GaAs surfaces using synchrotron radiation.
- High-resolution absorption spectroscopy using synchrotron radiation of defects in compound semiconductors and nanotubes.

Selected Research Grants:

- Year: 2007 National Science Foundation, Croatia
Project: Foundation of Laboratory for Surface and Materials Science
- Year: 2007 Ministry of Science, Education and Sport of Republic of Croatia
Project: Investigation of Nitrogen Related Defects in Compound Semiconductors
- Year: 2004 Australian Nuclear Science and Technology Organisation, Access to Major Research Facilities
Project: Surface Band-bending on Ion-bombarded GaN Surfaces
Project: High Resolution NEXAFS and Core-level Photoemission studies from Ion-bombarded Group III-nitrides
- Year: 2003 Australian Nuclear Science and Technology Organisation, Access to Major Research Facilities
Project: FEL-based Resonance Ionisation Spectrometry of Impurities from Semiconductor Surfaces
Project: Synchrotron-based Photoemission Studies of Composition Changes on III-N-V Surfaces under Low Energy Ion Bombardment
- Year: 2002 Australian Research Council, Discovery Grant (J.S.Williams and M.Petravic)
Project: Nanocavities and Nanoparticles in Silicon-based Materials Tailored by Ion Implantation
- Year: 2002 Australian Nuclear Science and Technology Organisation, Access to Major Research Facilities
Project: Structural Characterisation of (In)GaAsN Epitaxial Layers by Photoemission Spectroscopy
Project: Synchrotron-based Photoemission Measurements from III-V Nitride Compounds
- Year: 2001 La Trobe University, Central large Grant (M.Petravic and B.F.Usher)
Project: Selective Photon-Stimulated Desorption of Impurities from Compound Semiconductor Surfaces
- Project: Australian Nuclear Science and Technology Organisation, Access to Major Research Facilities
Project: Selective Photodesorption of Hydrogen Ions from Hydrogenated GaAs
- Year: 2000 Australian Nuclear Science and Technology Organisation, Access to Major Research Facilities
Project: Selective Photodesorption of Hydrogen Ions from Hydrogenated GaAs
- Year: 1999. Australian Research Council, RIEF Grant (B.V.King, M.Pellin, M.Petravic, and R.G.Clark)
Project: Surface Analysis Using a Free Electron Laser
- Year: 1998. Department of Industry, Technology and Regional Development, Access to Major Research Facilities
Project : Study of GaAs by Synchrotron Radiation Spectroscopies
- Year: 1998. European Commission Grant under the Access to Large-Scale Facilities

Project: Program to use the synchrotron research facilities in Orsay, France
 Study of GaAs by Synchrotron Radiation Spectroscopies

Year: 1997. Department of Industry, Science and Technology, Bilateral Science and Technology
 Grant for Co-operative Research with France

Project: Photon Stimulated Desorption of Negative Ions from Semiconductor
 Surfaces

Year: 1997. Department of Industry, Science and Technology, Bilateral Science and Technology
 Grant for Co-operative Research with Sweden

Project: Migration of Impurities in Silicon during SIMS Analysis with Oxygen Ions

Year: 1997. Department of Industry, Technology and Regional Development, Access to Major
 Research Facilities

Project: Photodesorption of Hydrogen Ions from Hydrogenated GaAs

Year: 1997. European Commission Grant under the Access to Large-Scale Facilities
 Program to use the synchrotron research facilities in Orsay, France

Project: Photodesorption of Hydrogen Ions from Hydrogenated GaAs

Year: 1996. Department of Industry, Technology and Regional Development, Access to Major
 Research Facilities

Project: Selective Photodesorption of Hydrogen from Diamond Surfaces

Year: 1996. European Commission Grant under the Access to Large-Scale Facilities
 Program to use the synchrotron research facilities in Orsay, France

Project: Selective Photodesorption of Hydrogen from Diamond Surfaces

Year: 1996. Australian Institute for Nuclear Science and Engineering Grant

Project: C and Zn Delta Doping of AlGaAs Structures

Year: 1995. Australian Institute for Nuclear Science and Engineering Grant

Project: SIMS Analysis of Semiconductor Structures

Year: 1995. Australian Institute for Nuclear Science and Engineering Grant

Project: Transient Enhanced Diffusion of B in Si

Year: 1994. Department of Industry, Technology and Regional Development, Bilateral Science
 and Technology Grant for Co-operative Research with Israel

Project: Electron Stimulated Desorption from Semiconductor Surfaces

Year: 1994. Australian Research Council, Large Grant

Project: Electron Stimulated Desorption of Hydrogen and Impurities from GaAs
 Surfaces

Year: 1992. Australian Research Council, Australian Postdoctoral Research Fellowship

Project: Electron Stimulated Desorption from Semiconductor Surfaces

Selected Collaborative Ventures:

- Project: Characterisation of defects in BN nanotubes
Partners: Professor Y.Chen, Deakin University, Australia; Dr W.-Y. Yang, NSRRC, Taiwan; Dr B. Cowie, Australian Synchrotron, Melbourne, Australia
- Project: Surface Analysis Using a Free Electron Laser
Partners: Professor B.V.King, University of Newcastle; Professor R.Clark, University of NSW; Dr M.J.Pelin, Dr S.Milton, Argonne National University, USA
- Project: Compositional changes on nitride semiconductor surfaces under low-energy ion bombardment studied by synchrotron-based spectroscopies;
Interaction of hydrogen with nitride semiconductor surfaces studied by synchrotron-based spectroscopies
Partners: Dr B.Kim, PAL, Korea; Dr W.-Y. Yang, NSRRC, Taiwan; Dr P.N.K.Deenapanray, EME, ANU
- Project: Photon Stimulated Desorption from Semiconductor Surfaces
Partners: Dr G.Dujardin, Dr G.Comtet and Dr L.Hellner, University Paris-Sud, Orsay, France; Dr P.N.K.Deenapanray, EME, ANU; Dr B.F.Usher, LaTrobe University
- Project: Photon Induced Fabrication of Atomic Scale Structures on Semiconductor Surfaces
Partners: Dr G.Comtet, University Paris-Sud, Orsay, France; Dr P.N.K.Deenapanray, EME, ANU
- Project: Selective Photon Stimulated Desorption of Hydrogen from GaAs Surfaces
Partners: Dr J.M.Chen, Synchrotron Radiation Research Center, Hsinchu, Taiwan; Dr P.N.K.Deenapanray, EME, ANU; Dr B.F.Usher, La Trobe University
- Project: Nanocavities and Nanoparticles in Silicon-based Materials Tailored by Ion Implantation
Partners: Professor J.S.Williams, ANU
- Project: Characterisation of Standards for Surface Composition and Sputter Depth Profiling
Partners: Dr D.W.Moon, Surface Analysis Group, Korean Research Institute of Standards and Science, Korea
- Project: Roughening of Si Surface under Oxygen and Nitrogen Bombardment
Partners: Dr D.W.Moon, Surface Analysis Group, Korean Research Institute of Standards and Science, Korea; Dr P.N.K.Deenapanray, EME, ANU
- Project: Arsenic diffusion in Ge
Partners: Dr P.N.K.Deenapanray, EME, ANU; Dr J.Likonen, Technical Research Center of Finland; Dr T.Ahlgren, University of Helsinki, Finland
- Project: Impurity-free Disorder in GaAs-based Materials
Partners: Dr P.N.K.Deenapanray, EME, ANU; Professor C.Jagadish, EME, ANU.

Service and Outreach Activities:

Chair, 1st Croatian Summer School on Synchrotron Radiation, SynCro'07, Rijeka, Croatia, 2007.

Member, Scientific Organising Committee, First Australian Synchrotron Summer School, Canberra, Australia, 2004.

Member, Organising Committee and Program Committee, 15th International Conference on Ion Beam Analysis, Cairns, Australia, 2001.

Member, Organising Committee, Program Committee, 16th Australian Conference on Electron Microscopy, Canberra, Australia, 2000.

Member, Program Committee and Session Chair, 11th International Conference on Secondary Ion Mass Spectrometry, Orlando FL, USA, 1997.

Member, Program Committee, 4th Vacuum Society of Australia Congress, Canberra, Australia, 1997.

Member, Organising Committee, Program Committee, 11th International Conference on Ion Beam Modification of Materials, Canberra, Australia, 1995.

Member, Scientific Promotion Committee in Physics in Republic of Croatia (since 2009).

Member, Senate of the University of Rijeka, 2007-2008.

Representative of the Republic of Croatia in the EC Committee for Mobility of Scientists in EU Research Area, 1996.

Referee for papers and proposals for SIMS and IBA conferences, scientific journals, the Australian Research Council, the National Science Foundation, Croatia and the Ministry of Science, Education and Sport of Republic of Croatia.

Justice of the Peace in Australia (since 2001).

List of CC Publications:

i) Book Chapters

1. B.V.King, M.A.Sobhan and M.Petravic, 'Ion beam mixing in metals', in "Surface Science, Principles and current Applications" (Springer-Verlag, Berlin 1996) p.127.

ii) Publications in Refereed Journals

2. M.Petravic, E.Tutis, A.Hamzic and L.Forro, 'Hall effect measurements in $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ ', *Solid State Commun.* **65**, 573 (1988).
3. M.Petravic, A.Hamzic, B.Leontic and L.Forro, 'Temperature dependence of the Hall effect in $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ and $\text{ABa}_2\text{Cu}_3\text{O}_7$ (A=Y,Gd) high temperature superconductors', *International Journal of Modern Physics* **B1**, 1067 (1987).
4. L.Forro, M.Petravic and B.Leontic, 'Hall effect of the high T_c superconductors Y-Ba-Cu-O and Gd-Ba-Cu-O', *Solid State Commun.* **65**, 1355 (1988).
5. J.R.Cooper, M.Petravic D.Drobac, B.Korin, N.Brnicevic, M.Paljevic and G.Collin, 'Low temperature AC susceptibility of yttrium barium copper oxide single crystals: attempts to measure the superconducting penetration depth', *Physica* **C153-155**, 1491 (1988).
6. M.Petravic, L.Forro, J.R.Cooper and F.Levy, 'Hall effect in the charge density wave system $(\text{NbSe}_4)_{10/3}\text{I}$ ', *Phys.Rev.* **B40**, 2885 (1989).
7. M.Petravic, L.Forro, J.R.Cooper and F.Levy, 'High-pressure study of a charge density wave compound $(\text{NbSe}_4)_{10/3}\text{I}$ ', *Phys.Rev.* **B40**, 8064 (1989).
8. M.C.Ridgway, R.G.Elliman, M.Petravic, R.P.Thornton and J.S.Williams, 'The influence of implanted impurities on the thermally-induced epitaxial recrystallization of CoSi_2 ', *J.Mat.Res.* **6**, 1035 (1991).
9. M.Petravic and J.S.Williams, 'Ion-induced noncollisional ejection of positive secondary ions', *Surf.Sci.* **259**, 215 (1991).
10. M.Petravic and J.S.Williams, 'Core ionization and ion ejection during SIMS analysis', *Nucl.Instrum.Meth.* **B64**, 659 (1992).
11. J.S.Williams, M.Petravic, Y.H.Li, J.A.Davies and G.Palmer, 'Precipitation and segregation of Sb at Si-SiO₂ interfaces during thermal oxidation', *Nucl. Instrum.Meth.* **B64**, 156 (1992).
12. L.Claphman, J.L.Whitton, M.C.Ridgway, N.Hauser and M. Petravic, 'High-dose, heavy-ion implantation into metals-the use of a sacrificial carbon surface layer for increased dose retention', *J.Appl.Phys.* **72**, 4041 (1992).
13. M.Petravic, B.G.Svensson and J.S.Williams, 'On the estimation of depth resolution during sputter profiling', *Appl.Phys.Lett.* **62**, 278, (1993).

14. J.S.Williams, R.G.Elliman, M.C.Ridgway, C.Jagadish, S.L.Ellingboe, R.Goldberg, M. Petravic, W.C.Wong, Z.Dezhang, E.Nygren and B.G.Svensson, 'MeV implantation into semiconductors', *Nucl.Instrum.Meth.* **B80/81**, 507 (1993).
15. B.G.Svensson, M.C.Ridgway and M. Petravic, 'Isotope effect for mega-electronvolt boron ions in amorphous silicon', *J.Appl.Phys.* **73**, 4836 (1993).
16. M. Petravic, J.S.Williams, and C.W.Wong, 'Electron stimulated desorption of positive and negative ions from SiO₂/Si surfaces', *Nucl.Instrum.Meth.* **B67**, 333 (1993).
17. S.Prawer, A.Hoffman, M. Petravic and R.Kalish, 'Conductivity in insulators due to implantation of conducting species', *J.Appl.Phys.* **73**, 3841 (1993).
18. M.Petravic, 'Desorption of positive and negative ions from SiO₂/Si surfaces by electron excitation of core levels', *Phys.Rev.* **B48**, 2627 (1993).
19. C.Jagadish, A.Clark, G.Li, C.A.Larsen, N.Hauser, M.Petravic, T.D.Thompson, T.Halstead and J.S.Williams, 'Characterization of III-V Multilayers Grown by Low-Pressure Metal Organic Vapour phase Epitaxy', *Aust.J.Phys.* **46**, 435 (1993).
20. J.S.Williams, R.D.Goldberg, M.Petravic and Z.Rao, 'Phase transformations and compound formation during ion irradiation of materials', *Nucl.Instrum.Meth.* **B84**, 199 (1994).
21. M.Petravic, 'Depth resolution during sputter profiling of Si in GaAs', *Nucl.Instrum.Meth.* **B85**, 388 (1994).
22. B.G.Svensson, M.Linnarsson, B.Mohadjeri, M. Petravic and J.S.Williams, 'SIMS and depth profiling of semiconductor structures', *Nucl.Instrum.Meth.* **B85**, 363 (1994).
23. J.S.Williams, M.Petravic, B.G.Svensson and M.Conway, 'Oxidation of silicon by low energy oxygen bombardment', *J.Appl.Phys.* **76**, 1840 (1994).
24. B.G.Svensson, B.Mohadjeri and M.Petravic, 'Surface recession and oxidation of silicon during bombardment by low energy oxygen ions', *J.Appl.Phys.* **76**, 3831 (1994).
25. J.Wong-Leung, C.E.Asheron, M.Petravic, R.G.Elliman and J.S.Williams, 'Gettering of copper to hydrogen-induced cavities in silicon', *Appl.Phys.Lett.* **66**, 1231 (1995).
26. M.Petravic and J.S.Williams, 'Desorption of positive and negative fluorine ions from BaF₂ surfaces by core level excitation under electron bombardment', *J.Vac.Sci.Technol.* **A13**, 26 (1995).
27. M.Petravic and J.S.Williams, 'Electronic effects in ion-stimulated desorption of positive halogen ions from semiconductor surfaces', *Nucl.Instrum.Meth.* **B101**, 64 (1995).
28. A.Hoffman, S.Moss, P.J.K.Patterson and M.Petravic, 'Electron stimulated desorption of positive and negative ions from YBa₂Cu₃O₇ surfaces', *J.Appl.Phys.* **78**, 6858 (1995).
29. G.Li, M.Petravic and C.Jagadish, 'Growth of Zn d-doped Al_xGa_{1-x}As by low pressure metal organic vapour phase epitaxy', *Appl.Phys.Lett.* **78**, 3546 (1995).

30. M.Petravic, J.S.Williams and A.Hoffman, 'Resonantlike desorption of negative ions by core-level excitation under electron bombardment', *Phys.Rev.* **B53**, 4257 (1996).
31. G.Li, M.Petravic and C.Jagadish, 'Very high carbon d-doping concentration in $\text{Al}_x\text{Ga}_{1-x}\text{As}$ grown by metal organic vapour phase epitaxy using trimethylaluminium as a doping precursor', *J.Appl.Phys.* **79**, 3554 (1996).
32. A.Hoffman and M.Petravic, 'Electron stimulated desorption of negative and positive hydrogen ions from hydrogenated silicon surfaces', *Phys.Rev.* **B53**, 6996 (1996).
33. B.Mohadjeri, M.Petravic, and B.G.Svensson, 'Oxidation-enhanced roughening of thin Co films during sputtering by O_2^+ ions', *J.Vac.Sci.Technol.* **A14**, 2192 (1996).
34. M.Petravic, B.G.Svensson, J.S.Williams and J.M.Glasko, 'Segregation effects in SIMS profiling of impurities in silicon by low energy oxygen ions', *Nucl.Instrum.Meth.* **B118**, 151 (1996).
35. K.S.Jones, R.G.Elliman, M.Petravic and P.Kringhoj, 'Using doping superlattices to study transient enhanced diffusion of boron in regrown silicon', *Appl.Phys.Lett.* **68**, 3111 (1996).
36. J.S.Williams, K.T.Short, M.Petravic and B.G.Svensson, 'Oxidation of silicon by low energy oxygen ions', *Nucl.Instrum.Meth.* **B121**, 24 (1997).
37. A.Kinomura, J.Wong-Leung, M.Petravic and J.S.Williams, 'Gettering of platinum and silver to cavities formed by hydrogen implantation in silicon', *Nucl.Instrum.Meth.* **B127/128**, 297 (1997).
38. G.Li, M.Petravic and C.Jagadish, 'Electrical activation of carbon d-doped (Al,Ga)As grown by metal organic vapour-phase epitaxy', *J. Crystal Growth* **173**, 302 (1997).
39. A.Kinomura, J.S.Williams, J.Wong-Leung and M.Petravic, 'Microstructural difference between platinum and silver trapped in hydrogen induced cavities in silicon', *Appl.Phys.Lett.* **72**, 2713 (1998).
40. I.Guzman, A.Hoffman, G.Comtet, M.Petravic, L.Hellner, G.Dujardin and A.Heurtel, *Appl.Phys.Lett.* **72**, 2517 (1998).
41. B.G.Svensson, M.K.Linnarsson, J.Cardenas and M.Petravic, 'SIMS analysis of epitaxial layers for power- and micro-electronics', *Nucl.Instrum.Meth.* **B136-138**, 1034 (1998).
42. J.Wong-Leung, J.S.Williams, and M.Petravic, 'The influence of cavities and point defects on boron diffusion in silicon', *Appl.Phys.Lett.* **72**, 2418 (1998).
43. J.S.Williams, M.Conway, J.A.Davies, M.Petravic, H.H.Tan and J.Wong-Leung, 'Analysis of semiconductors by ion channeling: applications and pitfalls', *Nucl.Instrum.Meth.* **B136-138**, 453 (1998).
44. A.Hoffman, G.Comtet, L.Hellner, G.Dujardin and M.Petravic, 'Surface near-edge x-ray adsorption fine structure of hydrogenated diamond films and $\text{Di}(100)$ surfaces studied by H^+ and H^- ion desorption', *Appl.Phys.Lett.* **73**, 1152 (1998).

45. M.Petravic, 'On the segregation of metals during low energy oxygen bombardment of silicon', *Appl.Surf.Sci.* **135**, 200 (1998).
46. G.Li, K.E.Prince, M.Petravic, S.J.Chua and C.J.Jagadish, 'Substrate orientation effect on Zn doping in GaAs grown by metal organic vapour phase epitaxy', *J. Crystal Growth* **191**, 357 (1998).
47. Shu Yuan, C.Jagadish, Y.Kim, Y.Chang, H.H.Tan, R.M.Cohen, M.Petravic, L.V.Dao, M.Gal, M.C.Y.Chan, E.H.Li, J.S.O and P.S.Zory, 'Anodic-oxide induced intermixing in GaAs/AlGaAs quantum well and quantum wire structures', *IEEE J.Select.Topics in Quantum Electronics* **4**, 629 (1998).
48. M.Petravic, J.S.Williams, M.Conway and P.N.K.Deenapanray 'On the nitridation of silicon by low energy nitrogen bombardment', *Appl.Phys.Lett.* **73**, 1287 (1998).
49. J.Cardenas, B.G.Svensson and M.Petravic, 'Evidence for the influence of thermal spikes on ion induced mixing in Si at energies between 3 and 300 keV', *J.Appl.Phys.* **84**, 4809 (1998).
50. A.Kinomura, J.S.Williams, J.Wong-Leung, M.Petravic, Y.Nakano and Y.Hayashi, 'Efficient gettering of low concentrations of copper contamination to hydrogen induced nanocavities in silicon', *Appl.Phys.Lett.* **73**, 2639 (1998).
51. P.N.K.Deenapanray and M.Petravic, 'Angular and energy dependence of the ion beam oxidation of Si using oxygen ions from a dupolasmatron source', *Surf.Interf.Analys.* **27**, 92 (1999).
52. A.Hoffman, M.Petravic, G.Comtet, L.Hellner, G.Dujardin and A.Heurtel, 'Photon stimulated desorption of positive and negative hydrogen ions from diamond surfaces: evidence for direct and indirect processes', *Phys.Rev.* **B59**, 3203 (1999).
53. P.N.K.Deenapanray and M.Petravic, 'On the migration behavior of metal impurities in Si during SIMS profiling using low-energy oxygen ions', *J.Appl.Phys.* **85**, 3993 (1999).
54. M.Petravic, A.Hoffman, G.Comtet, L.Hellner and G.Dujardin, 'Photon-stimulated desorption of hydrogen ions from semiconductor surfaces: evidence for direct and indirect processes', *Fizika* **A8**, 275 (1999).
55. J.S.Williams, M.J.Conway, J.Wong-Leung, P.N.K.Deenapanray, M.Petravic, R.A.Brown, D.J.Eaglesham and D.C.Jacobson, 'The role of oxygen on the stability of gettering of metals to cavities in silicon', *Appl.Phys.Lett.* **75**, 2424 (1999).
56. P.N.K.Deenapanray and M.Petravic, 'Segregation effects of Li, K and F in Si during depth profiling by oxygen ions', *J.Appl.Phys.* **87**, 2178 (2000).
57. P.N.K.Deenapanray and M.Petravic, 'On the segregation of Ca at SiO₂/Si interface during oxygen ion bombardment', *Surf.Interf.Analysis* **29**, 160 (2000).
58. M.Petravic, P.N.K.Deenapanray, G.Comtet, L.Hellner, G.Dujardin, and B.F.Usher, 'Selective Photon-Stimulated Desorption of Hydrogen from GaAs Surfaces', *Phys.Rev.Lett.* **84**, 2255 (2000).
59. D.W.Moon, J.Y.Won, K.J.Kim, H.J.Kim, H.J.Kang and M.Petravic, 'GaAs delta-doped layers

in Si for evaluation of SIMS depth resolution", *Surf.Interf.Analysis* **29**, 362 (2000).

60. P.N.K.Deenapanray, H.H.Tan, M.I.Cohen, K.Gaff, M.Petravic, C.Jagadish, 'Silane flow rate dependence of SiO_x cap layer induced impurity-free intermixing of GaAs/AlGaAs quantum wells', *J.Electrochem.Soc.* **147**, 1950 (2000).
61. P.N.K.Deenapanray, L.Fu, M.Petravic, C.Jagadish, B.Gong and R.N.Lamb, 'Pulsed anodic oxidation of GaAs for impurity-free interdiffusion of GaAs/AlGaAs quantum wells', *Surf.Interf.Analysis* **29**, 754 (2000).
62. B.Stritzker, M.Petravic, J.Wong-Leung and J.S.Williams, 'Selectivity of nanocavities and dislocations for gettering of Cu and Fe in silicon', *Appl.Phys.Lett.* **78**, 2682 (2001).
63. B.Stritzker, M.Petravic, J.Wong-Leung and J.S.Williams, 'Efficiency of dislocations and cavities for gettering of Cu and Fe in silicon', *Nucl.Instrum.Meth.* **B175-177**, 154 (2001).
64. P.N.K.Deenapanray and M.Petravic, 'Low energy O₂⁺ and N₂⁺ beam-induced profile broadening effects in Si', *J.Vac.Sci.Technol.* **A19**, 893 (2001).
65. J.S.Williams, M.C.Ridgway, M.J.Conway, J.Wong-Leung, X.F.Zhu, M.Petravic, F.Fortuna, M.-O.Ruault, H.Bernas, A.Kinomura, Y.Nakano and Y.Hayashi, 'Interaction of defects and metals with nanocavities in silicon', *Nucl.Instrum.Meth.* **B178**, 33 (2001).
66. M.Petravic and P.N.K.Deenapanray, 'Electrical transients in the ion-beam induced nitridation of silicon', *Appl.Phys.Lett.* **78**, 3445 (2001).
67. M.J.McCann, K.J.Weber, M.Petravic and A.W.Blakers, 'Boron Doping of Silicon Layers Grown by Liquid-Phase-Epitaxy', *J. Crystal Growth* **241**, 45 (2002).
68. M.Petravic, P.N.K.Deenapanray, B.F.Usher, K.-J.Kim and B.Kim, 'High-resolution photoemission study of hydrogen interaction with polar and non-polar GaAs surfaces', *Phys.Rev.* **B67**, 195325 (2003).
69. M.Petravic, P.N.K.Deenapanray, K.-J.Kim and B.Kim, 'Compositional changes on GaN surfaces under low-energy ion bombardment studied by synchrotron-based spectroscopies', *Appl.Phys.Lett.* **83**, 4948 (2003).
70. M.Petravic, P.N.K.Deenapanray, V.A.Coleman, K.-J.Kim, B.Kim and G.Li, 'Core-level photoemission and near edge x-ray absorption fine structure studies of GaN surface under low-energy ion bombardment', *J.Appl.Phys.* **95**, 5487 (2004).
71. I. V. Veryovkin, W. F. Calaway, J. F. Moore, M. J. Pellin, S.V.Milton, B.V.King and M. Petravic, 'A new horizon in secondary neutral mass spectrometry: post-ionization using a VUV free electron laser', *Appl.Surf.Sci.* **231**, 962 (2004).
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