

Asian School-Conference on
**Physics and Technology of
Nanostructured Materials**
Vladivostok, 21 - 28 August

PROCEEDINGS

Vladivostok
2011

Asian School-Conference on Physics and Technology of Nanostructured Materials

Vladivostok, Russia, August 21 – 28, 2011

PROCEEDINGS

**Vladivostok
Dalnauka
2011**

**Asian School-Conference on Physics and Technology of
Nanostructured Materials: Proceedings.** – Vladivostok, Dalnauka, 2011. – 252 p.

ISBN 978-5-8044-1206-8

Copyright © 2011 by Institution of Russian Academy of Science Institute of Automation and Control Processes Far Eastern Branch of RAS. All rights reserved. No part of this publication may be multiple copied, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the written permission of the publisher. Single photocopies of single articles may be made for private study or research.

The Proceedings include extended abstracts of invited talks and contributed papers of the school-conference. The abstracts reflect the new results and scientific achievements in the field of new materials, nanotechnology and surface science. This proceedings volume is intended for scientist, teachers and post-graduate students.

The School-Conference is supported by grants of RFBR (No 11-02-068-12-mob_g) and FEB RAS (No 11-III-G-02-005)

Contents

Invited lectures

PS.22.01i	Surface nanomaterials - structures and properties <i>Shuji Hasegawa</i>	15
PS.22.02i	C ₆₀ fullerenes on reconstructed Si(111) surfaces <i>A.V. Zotov, A.V. Matetskiy, L.V. Bondarenko, D.V. Gruznev, A.A. Saranin</i>	19
PS.22.03i	Application of modulation spectroscopy to study of low dimensional semiconductor heterostructures <i>R. Kudrawiec</i>	21
PS.22.04i	Surface modifications for GaN heteroepitaxy and nanostructure formation <i>S.M. Shivaprasad</i>	22
PS.23.01i	Fabrication and properties of nanostructured refractory metal oxides <i>V.E. Borisenko</i>	24
PS.23.02i	Synthesis and structure of hi-silica zeolite modified by nanoparticles <i>E.S. Astapova, E.A. Vanina</i>	26
PS.23.03i	Thermodynamics, growth evolution and structural property of abundant semiconducting materials: novel silicides, and oxide nanostructures <i>H. Tatsuoka, A. Kato, C. Wen, Q. Yang</i>	29
PS.23.04i	Computational multiscale modeling of nanosystems <i>A.V. Vakhrushev</i>	33
PS.25.01i	Operation principles of solar cells - solar radiation, material requirements, photocurrent, photoresponse, and device configuration using semiconducting silicide BaSi ₂ <i>T. Suemasu, M. Ajmal Khan, T. Saito, K. Toh, A. Okada, M. Baba, K. Nakamura, Du Weijie, T. Sekiguchi, N. Usami</i>	35
PS.25.02i	Pulsed synthesis and modification of thin-film semiconductor structures for micro- and optoelectronics <i>R.M. Bayazitov</i>	38
PS.25.03i	Indirect band gap heterostructures with band alignment of type I on the basis of III-V semiconductor compounds <i>T.S. Shamirzaev</i>	39
PS.25.04i	Coherent optics sensors and sensing systems for physical fields and technical objects monitoring and nanotechnology <i>Yu.N. Kulchin, O.B. Vitrik</i>	42
PS.26.01i	Charge transfer induced electrical conduction variation in contaminated carbon nanotubes <i>Jun Wei Fan, Chung-Yi Lin, Shih-Jye Sun</i>	43
PS.26.02i	Optical and transport properties of low-dimensional semiconductor nanostructures <i>K. Král, M. Menšík</i>	44
PS.26.03i	Characterization and magnetic properties of the iron silicides <i>S.G. Ovchinyikov, S.N. Varnakov, A.S. Fedorov, S.A. Lyaschenko, I.A. Yakovlev</i>	48
PS.26.04i	Opportunities in nanostructured metal oxides based biosensors <i>Bansi D Malhotra</i>	51
PS.27.01i	Iron silicides for optoelectronics; a new technology using “elements of hope” <i>Yoshihito Maeda</i>	54

1. Atomic-scale controlled surfaces/interfaces and nanostructure self organization

I.22.01o	Crystalline and electronic structure of C ₆₀ monolayers on Si(111)- α - $\sqrt{3}\times\sqrt{3}$ -Au <i>A.V. Matetskiy, D.V. Gruznev, A.V. Zotov, A.A. Saranin</i>	61
I.22.02o	Periodical surface structures on silicon induced by IR and UV femtosecond laser pulses <i>V.I. Emel'yanov, E.V. Golosov, A.A. Ionin, S.I. Kudryashov, A.E. Ligachev, S.V. Makarov, D.V. Sinitsin, L.V. Seleznev, Yu.R. Kolobov</i>	63

I.22.03o	MnSi film on Si(111): its terminations and surface properties <i>S.G. Azatyan, O.A. Utas, N.V. Denisov, A.V. Zotov, A.A. Saranin</i>	65
I.22.04o	Study of the size dependent electronic d-band behavior of gold nano-clusters <i>A. Visikovskiy, H. Matsumoto, K. Mitsuhashi, T. Nakada, T. Akita, Y. Kido</i>	67
I.22.05o	Post-processing of contactless electroreflectance signal by using wavelets <i>J. Pietrucha, R. Kudrawiec</i>	69
I.22.06o	STM studies of temperature induced reconstructions on Si(111) <i>Mahesh Kumar, Praveen Kumar, S.M. Shivaprasad</i>	70
I.22.07o	An influence of Mg adsorption on the Si(5 5 12) substrate conductivity and surface morphology <i>D.L. Goroshko, K.N. Galkin, N.G. Galkin, M. Kumar, S.M. Shivaprasad</i>	72
PO.I.23.01	Nanostructure formation on metal surface by electric discharge <i>S.A. Pyachin, A.A. Burkov, A.P. Kuz'menko, D.I. Timakov</i>	74
PO.I.23.02	High-temperature Electron Stimulated Desorption from amorphous alumina films on silicon substrate <i>M.V. Ivanchenko, V.A. Gritsenko, A.V. Nepomnyaschiy, A.A. Saranin</i>	76
PO.I.23.03	Micromorphology and spectroscopic ellipsometry of Ni(100) crystal surface <i>T.A. Gavrilova, V.V. Atuchin, V.N. Kruchinin, D.V. Lychagin</i>	78
PO.I.23.04	Structure and micromorphology of titanium dioxide nanoporous microspheres formed in water solution <i>I.B. Troitskaia, T.A. Gavrilova, V.V. Atuchin</i>	80
PO.I.23.05	Silicon nanocrystals formation by means of e-beam lithography and dry gas etching <i>Yu. V. Nastaushchev, T.A. Gavrilova, S.F. Devyatova, D.A. Nasimov, T.V. Kozlova, A.V. Latyshev</i>	82
PO.I.23.06	The study of Si(5 5 12) cleaning in the ultra-high vacuum conditions <i>K.N. Galkin, E.A. Chusovitina, M. Kumar, S.M. Shivaprasad, N.G. Galkin</i>	84
PO.I.23.07	Si/Low-dimensional Mg ₂ Si/Si heterostructures: electrical and thermoelectrical properties <i>K.N. Galkin, N.G. Galkin</i>	86
PO.I.23.16	Role of C ₆₀ as acceptors for Si(111)α-√3×√3-Au <i>M.V. Ryzhkova, D.A. Gruznev, L.V. Bondarenko, E.V. Borisenko, D.A. Tsukanov</i>	88
PO.I.23.17	Mn-induced structures of Au on Si(111): Si(111)N×2-(Au, Mn) and Si(111)2√21×2√21-(Au, Mn) <i>N.V. Denisov, A.A. Yakovlev, O.A. Utas, S.G. Azatyan, A.V. Zotov, A.A. Saranin</i>	90

2. Nanoscaled Si, Ge, A₃B₅ materials: formation technology, structure and characterization

II.22.08o	Novel system of GaSb/GaP quantum dots grown on mismatched GaAs substrate <i>D.S. Abramkin, M.A. Putyato, T.S. Shamirzaev</i>	95
II.22.09o	Formation and orientation control of Al-induced crystallized Si thin films on conducting layers <i>A. Okada, N. Usami, T. Suemasu</i>	97
II.22.10o	Fabrication of magnesium germanide nanorods from Ge nanorod templates <i>C.L. Wen, Q. Yang, H. Hara, M. Suzuki, W. Li, S.M. Cai, H. Tatsuoka</i>	99
PO.II.25.15	Structure and luminescence of free-standing CdS quantum dots and their clusters fabricated by Langmuir-Blodgett technique on surface of SiO ₂ film <i>A.A. Zarubanov, K.A. Svit, D.Yu. Protasov, L.A. Sveshnikova, K.S. Zhuravlev</i>	101

3. Nanosilicides and bulk silicides: theory, synthesis and characterization

III.26.01o	MicroChannel epitaxy of β-FeSi ₂ on Si(001) substrate <i>M. Suzuno, K. Akutsu, H. Kawakami, T. Yaguchi, K. Akiyama, T. Suemasu</i>	105
III.26.02o	High quality undoped BaSi ₂ grown on n ⁺ -BaSi ₂ /p ⁺ -Si tunnel junction with reduced Sb diffusion <i>Du Weijie, Takano Saito, Muhammad Ajmal Khan, Kotaro Nakamura, Masakazu Baba, Katsuaki Toh, Noritaka Usami, Takashi Suemasu</i>	107

I.26.03o	Determination of structural parameters of the Fe-Si-system by spectral ellipsometry method <i>S.A. Lyaschenko, S.N. Varnakov, S.G. Ovchinnikov, E.P. Berezhitskaya, G.A. Alexandrova, O.P. Vaituzin</i>	109
I.26.04o	Correlation between resonant tunneling voltages and Fe ₃ Si quantum well widths in ferromagnetic CaF ₂ /Fe ₃ Si /CaF ₂ resonant tunneling diode <i>K.S. Makabe, M. Suzuno, K. Harada, H. Akinaga, T. Suemasu</i>	111
III.26.05o	CEMS analysis of nanostructured films (Fe/Si) ₃ with Fe ⁵⁷ active layer <i>S.N. Varnakov, S.G. Ovchinyikov, Juan Bartolomé, Javier Rubin, Laura Badía</i>	113
III.26.06o	Photoreflectance and time-resolved photoluminescence studies in ion-beam synthesized β-FeSi ₂ <i>Y. Terai, K. Noda, K. Yoneda, Y. Maeda, Y. Fujiwara</i>	115
III.26.07o	Growth condition dependence of direct bandgap in β-FeSi ₂ epitaxial films grown by molecular beam epitaxy <i>K. Noda, Y. Terai, K. Yoneda, N. Miura, K. Katayama, H. Udono, Y. Fujiwara</i>	117
III.26.08o	Structural and electrical properties of β-FeSi ₂ bulk materials for thermoelectric applications <i>H. Yamada, H. Katsumata, S. Uekusa</i>	119
III.26.09o	An influence of Si(111)-2×2-Fe surface reconstruction on the formation, morphology and optical properties of manganese silicide <i>S.A. Dotsenko, K.N. Galkin, E.A. Chusovitin, N.G. Galkin, D.L. Goroshko</i>	121
PO.II.25.01	Self organization of FeGe/FeSi/FeGe layered structures on Ge and their electrical conduction properties <i>Bui Matsukura, Yusuke Hiraiwa, Takahito Nakajima, Kazumasa Narumi, Seiji Sakai, Taizoh Sadoh, Masanobu Miyao, Yoshihito Maeda</i>	123
PO.II.25.02	Photoluminescence properties of ion-beam-synthesized β-FeSi ₂ nanocrystals in Si <i>Takahito Nakajima, Takayuki Ichikawa, Bui Matsukura, Yoshihito Maeda</i>	125
PO.II.25.03	Investigation of Fe silicides formation on Si (100) by molecular-beam epitaxy and solid-phase epitaxy <i>I.A. Yakovlev, S.N. Varnakov, S.G. Ovchinyikov</i>	127
PO.II.25.04	Structural and electrical properties of β-FeSi ₂ thin films prepared by RF magnetron sputtering <i>M. Sawada, Y. Tomokuni, H. Katsumata, S. Uekusa</i>	129
PO.II.25.05	Growth of Mg silicide on amorphous Si <i>S.A. Dotsenko, N.G. Galkin, D.L. Goroshko, K.N. Galkin, E.A. Chusovitin, A.S. Guralnik, A.I. Cherednichenko</i>	131
PO.II.25.06	Formation, optical and electrical properties of a new semiconductor phase of calcium silicide on Si(111) <i>S.A. Dotsenko, K.N. Galkin, D.A. Bezbabny, D.L. Goroshko, N.G. Galkin</i>	133
PO.II.25.09	Pulsed synthesis of Mg ₂ Si precipitates in Mg-implanted silicon <i>S.V. Vavanova, K.N. Galkin, N.G. Galkin, R.I. Batalov, R.M. Bayazitov</i>	135
PO.II.25.18	Enhancement of photoresponsivity, minority-carrier diffusion length and lifetime in β-FeSi ₂ films grown by atomic hydrogen-assisted molecular beam epitaxy <i>H. Kawakami, M. Suzuno, K. Akutsu, T. Yaguchi, J. Chen, K. Jiptner, T. Sekiguchi, T. Suemasu</i>	137

4. First principal calculations and molecular modeling of nanostructures

IV.25.03o	First principle simulations of the minimum energy path of the Si-defect on the Si(111)√3×√3-Me surface, Me = Al, Ga, In, Pb <i>Yu.V. Luniakov</i>	141
IV.25.04o	First principle simulation of the Co layers behavior on a surface of hexagonal tungsten carbide <i>A.A. Gnidenko</i>	143
IV.25.05o	First principal investigation of metal-silicon compounds <i>A.S. Fedorov, Z.I. Popov, A.A. Kuzubov, T.A. Kojevnikova, S.G. Ovchinnikov</i>	145
IV.25.06o	Molecular dynamics simulation of multilayered nanoheterostructures with variable chemical bonds <i>O.Yu. Severyukhina</i>	147

PO.I.23.08	Charge transfer simulation in environment coupled organic semiconductors <i>Jun Wei Fan, Chung-Yi Lin, Hsiung Chou, Shih-Jye Sun</i>	149
PO.I.23.09	Ab initio modeling of noble metals behavior in perfect and defective graphite <i>V.G. Zavodinsky, E.A. Mikhailenko</i>	150
PO.I.23.10	Theoretical studing of mechanical properties of small tin nanoparticles <i>M.A. Kulik</i>	152
PO.I.23.19	Molecular dynamics investigation of the structural properties of Cu-Au nanoclusters <i>V.S. Myasnichenko, M.D. Starostenkov</i>	154
PO.I.23.20	The simulation of processes of composite nanoparticle having different structure formation <i>A.Yu. Fedotov</i>	156
PO.I.23.23	First principle calculations of the cation substitution effect on the electronic structure of the nanoporous silica <i>A.N. Chibisov, M.A. Chibisova</i>	158

5. Formation and properties of ferromagnetic and ferroelectric materials and nanosystems

V.25.07o	Multifractal analysis of electron beam induced polarization switching processes in ferroelectrics <i>A.G. Maslovskaya, T.K. Barabash</i>	163
V.27.05o	Growth and magnetism of Co films on Cu(111) buffer layer on Si(111)7×7 <i>Yu.P. Ivanov, A.I. Ilin</i>	165
V.27.06o	Realization of an anti-parallel state of magnetization orientation for measuring TMR effects in Fe/Fe ₃ Si/CaF ₂ /Fe ₃ Si MTJ structure <i>K. Harada, K.S. Makabe, H. Akinaga, T. Suemasu</i>	167
V.27.07o	MTJ spin-valves based on thin films and nanowires <i>A.S. Samaradak, E.V. Sukovatitsina, A.V. Ognev, M.E. Steblyy, V.S. Plotnikov, E.V. Pustovalov, E. Wahlström, L.A. Chebotkevich</i>	169
V.27.08o	Injection from contacts and asymmetry of photocurrent oscillations in narrow-gap PbSnTe:In ferroelectric <i>A.E. Klimov, N.S. Paschin, V.N. Shumsky</i>	171

6. Optical materials, photonic crystals and nanometrology

VI.26.10o	Growth and surface stability of Bi ₂ Se ₃ crystals <i>V.V. Atuchin, K.A. Kokh, I.P. Prosvirin, K.N. Romanyuk, A.S. Kozhukhov, S.V. Makarenko, O.E. Tereshchenko</i>	175
VI.26.11o	Remote optical method for monitoring the parameters of hydroacoustic vibrations <i>Y.N. Kulchin, O.B. Vitrik, N.P. Kraeva</i>	177

7. Nanostructured coatings: formation technology and properties

VII.27.01o	Fluorocarbon materials produced by the thermo destruction of polytetrafluoroethylene and possibility of theirs application in Li(CF _x) _n batteries <i>D.P. Opra, S.L. Sinebryukhov, A.K. Tsvetnikov, V.G. Kuryiviyi, L.A. Matveenko, S.V. Gnedenkov</i>	181
VII.27.02o	Microscale morphology and properties of the PEO-coating surface <i>A.S. Gnedenkov, S.L. Sinebryukhov, D.V. Mashtalyar, S.V. Gnedenkov</i>	183
VII.27.03o	XMCD measurements for γ'-Fe ₄ N thin films grown by MBE <i>K. Ito, G.H. Lee, K. Harada, M. Ye, Y. Takeda, Y. Saitoh, T. Suemasu, A. Kimura, H. Akinaga</i>	185
VII.27.04o	Films, prepared with laser ablation of Ni-Pd targets <i>A.G. Bagmut, I.A. Bagmut, V.A. Zhuchkov, I.G. Shipkova</i>	187
PO.I.23.11	Effect of PEO-modes on the electrochemical and mechanical properties of coatings on MA8 magnesium alloy <i>M.V. Sidorova, S.L. Sinebrukhov, O.A. Khrisanfova, S.V. Gnedenkov</i>	189

PO.I.23.12	Nanointervention into mineral universe. II. Electronic structure of clinobarylite, BaBe ₂ Si ₂ O ₇ , from Khibiny massif, Kola peninsula <i>V.V. Atuchin, V.G. Kesler, V.N. Yakovenchuk</i>	191
PO.I.23.13	Properties of nanostructured copper molybdenum covers on oxidized titan for catalytic diesel soot burning <i>N.V. Lebukhova, P.G. Chigrin, K.S. Makarevich, V.S. Rudnev</i>	193
PO.I.23.14	Electrospark coatings formation on hard alloys <i>I.A. Astapov, M.A. Teslina, S.N. Khimukhin</i>	195
PO.I.23.21	Comparison of superionic phases for some fluorine conducting materials <i>A.B. Podgorbunsky, S.L. Sinebryukhov, S.V. Gnedenkov</i>	196

8. Nanocomposites and functional hybrid materials: formation technology, structure and characterization

VIII.23.01o	Optical Properties of ZnTiO ₃ thin films prepared by radio frequency magnetron sputtering <i>C. Ye, Y. Wang, Y. Ye, Y.C. Jin, Q.X. Wei</i>	201
VIII.23.02o	The X-ray diffraction study of three-dimensional disordered network of nanographites: experiment and theory <i>N.S. Saenko</i>	204
VIII.23.03o	Characterization of functional hybrid materials by electrochemical impedance spectroscopy <i>V.S. Egorkin, L.B. Boinovich, D.V. Mashtalyar, S.L. Sinebryukhov, S.V. Gnedenkov</i>	206
VIII.23.04o	Development of microwave absorbing materials prepared from a polymer binder including Japanese lacquer and epoxy resin <i>Toraki Iwamaru, Hiroshi Katsumata, Shinichiro Uekusa, Hiroki Ooyagi, Takahisa Ishimura, Tetsuo Miyakoshi</i>	208
VIII.23.05o	Influence of defects on strength and hardness of submicron WC-8Co-1Cr ₃ C ₂ hard alloy <i>M.I. Dvornik, A.V. Zaytsev, E.A. Mikhaylenko</i>	210
VIII.23.06o	Formation of TiO ₂ nanocoatings by laser ablation <i>M.A. Pugachevsky, N.B. Kozlenkova, K.S. Makarevich</i>	212
PO.I.23.22	Nanointervention into mineral universe. I. Epitaxial contacts for Hg-containing compounds <i>V.V. Atuchin, S.V. Borisov, S.A. Magarill, N.V. Pervukhina</i>	214
PO.II.25.07	Thermal analysis of high-silica zeolites with transitional metal nanoparticles <i>S.S. Pavlov, E.S. Astapova</i>	216
PO.II.25.08	The structural characteristics and the stability of high-silica zeolites modified with nanodispersed powder of metals <i>V.S. Radomskiy, E.S. Astapova</i>	218
PO.II.25.10	Interrelationship “composition – structure – property” for Cu- and Ge-bearing sulfides <i>V.V. Atuchin, B.I. Kidyarov</i>	220
PO.II.25.11	The production of nanosilica by fluorine method <i>A.A. Pushkin, A.N. Zhitenev</i>	222
PO.II.25.12	Zincite precipitation on ZnWO ₄ (010) cleaved surface by annealing <i>V.V. Atuchin, E.N. Galashov, A.S. Kozhukhov, L.D. Pokrovsky, V.N. Shlegel</i>	224
PO.II.25.13	Doped vanadium oxides nanorods <i>G.S. Zakharova, M.V. Kuznetsov, N.V. Podval'naya</i>	226
PO.II.25.14	Formation of α-MoO ₃ (010) micropalettes for nanoarchitecture <i>I.B. Troitskaia, T.A. Gavrilova, V.V. Atuchin, D.V. Sheglov</i>	228
PO.II.25.16	Investigation of thermal noise in nanoscale sodium nitrite <i>E.V. Stukov, S.B. Baryshnikov, Yu.A. Satskaya, E.V. Charnaya, Yu.V. Patrushev</i>	230

9. Biohybrids and biomaterials: biomimetic materials, biomineralisation, and biosystems

IX.23.07o	Measurements of fast nonlinear optical properties of biomimetic materials <i>A.A. Chekhlenok, D.Yu. Proshchenko, S.S. Golik, A.V. Bezverbny</i>	235
-----------	--	-----

IX.23.08o	Investigation of the humidity influence on optical properties of chitosan thin films by spectroscopic ellipsometry <i>V.A. Kolchinskiy, A.Y. Mironenko, S.S. Voznesenskiy, S.Y. Bratskaya, A.V. Nepomnyaschiy</i>	237
PO.I.23.15	Investigation of humidity influence upon waveguide features of chitosan thin films <i>A.A. Sergeev, S.S. Voznesenskiy, S.Y. Bratskaya, A.Y. Mironenko, R.V. Lagutkin</i>	239
PO.I.23.18	Propagation of ultrashort pulses in new biosilica nanocomposite materials <i>D.Yu. Proshchenko, A.A. Chekhlenok, A.V. Bezverbny, S.S. Golik</i>	241

10. Photonic devices, solar cells, nanophotonics and biophotonics

X.25.01o	Optimization and control of electron and hole concentrations in Cu- and Ag-doped BaSi ₂ grown by molecular beam epitaxy for the formation of efficient solar cells <i>M. Ajmal Khan, Takanobu Saito, Katsuaki Toh, Masakazu Baba, Kotaro Nakamura, Du Weijie, Takashi Suemasu</i>	245
X.25.02o	Optical spin detection in Pd/Fe/GaAs/InGaAs structures <i>O.E. Tereshchenko, A.G. Paulish, T.S. Shamirzaev, A.M. Gylinsky, D.V. Dmitriev, A.I. Toropov, X. Li, G. Lampel, Y. Lassailly, D. Paget, J. Peretti</i>	247
	Author Index	249