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Research interests

Molecular beam epitaxy, III-V semiconductors on silicon, nanowires, nanophotonics, photovoltaics, structure characterisation

Education

Saint-Petersburg Academic University Saint-Petersburg, Russia
PhD in Physics of Condensed Matter sep 2016 – jul 2021
Thesis: "Molecular Beam Epitaxy of Gallium Nitride, Gallium Arsenide, and Gallium Phosphide Nanostructures on Silicon"
Mentors: Bolshakov A, D.

Saint-Petersburg Academic University Saint-Petersburg, Russia
MS in Electronics and Nanoelectronics sep 2014 – aug 2016
Mentors: Bolshakov A, D.

Tambov State Technical University Tambov, Russia
BS in Nanotechnology, sep 2010 – aug 2014

Honors and scholarships

Grant for young scientists of universities and academic institutions located in Saint-Petersburg (Committee on Science and Higher Education) 2020

Scholarship of the Government of the Russian Federation in priority areas of modernization and technological development of the Russian economy (Government of the Russian Federation) 2019

Grant for university students located in Saint-Petersburg, graduate students of universities, industry and academic institutions located in Saint-Petersburg (Committee on Science and Higher Education) 2018

Skills

Molecular beam epitaxy
GaAs, GaP and GaP(NAs) planar growth, GaN, GaAs, GaP nanowire growth on silicon substrate using a molecular-beam epitaxy system Veeco GEN-III

Structure characterisation
Reflection high-energy electron diffraction, Atomic Force Microscopy, Raman and Photoluminescence spectroscopy.

Experience in Scanning and Transmission electron microscopy, Secondary ion mass spectrometry and X-ray diffraction data interpretation.

Data analysys and visualisation
Python (NumPy, Pandas, Scikit-learn, Keras, Tensorflow, Matplotlib), Machine learning, Gwyddion, Origin.

Computer graphics
Blender, Gimp, Inkscape.

Languages
Russian (native), English (upper-intermediate), French (intermediate), Japanese (intermediate)

Research experience

Saint-Petersburg Academic University, Laboratory of Renewable Energy Sources
Mentors: Bolshakov A. D. sep 2014 – aug 2021

- Study of GaN nanowire formation, morphology optimisation for device implementation.
- Study of III-V nanostructure formation on silicon substrates, mainly GaP nanowires with GaP(NAs) heterojunctions.
- GaP(NAs) growth on silicon and sapphire, developing of III-V solar cells on silicon substrates.
- Design, growth and heterostructure optimization for device implementation, such as solar cells with carbon nanotubes as a top contact and flexible LED based on GaP(AsN) nanowires.

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Q1 Publications

Work function tailoring in gallium phosphide nanowires
Sharov V., Alekseev P., Fedorov V., Nestoklon M., Ankudinov A., Kirilenko D., Sapunov G., Koval O., Cirlin G., Bolshakov A., Mukhin I.
Applied Surface Science (IF: 6.182), 2021.

Tailoring Morphology and Vertical Yield of Self-Catalyzed GaP Nanowires on Template-Free Si Substrates
Fedorov V. V., Berdnikov Y., Sibirev N. V., Bolshakov A. D., Fedina S. V., Sapunov G. A., Dvoretckaia L. N., Cirlin G., Kirilenko D. A., Tchernycheva M., Mukhin I. S.
Nanomaterials (IF: 5.093), 2021.

XRD Evaluation of Wurtzite Phase in MBE Grown Self-Catalyzed GaP Nanowires

Koval O. Y., Fedorov V. V., Bolshakov A. D., Eliseev I. E., Fedina S. V., Sapunov G. A., Udovenko S. A., Dvoretckaia L. N., Kirilenko D. A., Burkovsky R.G., Mukhin I.S.
Nanomaterials (IF: 5.093), 2021.

Single GaN Nanowires for Extremely High Current Commutation
Shugurov K., Mozharov A., Sapunov G., Fedorov V., Tchernycheva M., Mukhin I.
Physica Status Solidi – Rapid Research Letters (IF: 2.975), 2021.

Structural and optical properties of self-catalyzed axially heterostructured GaPN/GaP nanowires embedded into a flexible silicone membrane
Koval O. Y., Fedorov V. V., Bolshakov A. D., Fedina S. V., Kochetkov F. M., Neplokh V., Sapunov G. A., Dvoretckaia L. N., Kirilenko D. A., Shtrom I. V. and Islamova R. M.
Nanomaterials (IF: 5.093), 2020.

Structural and optical characterization of dilute phosphide planar heterostructures with high nitrogen content on silicon
Koval O. Y., Fedorov V. V., Kryzhanovskaya N. V., Sapunov G. A., Kirilenko D. A., Pirogov E. V., Filosofov N. G., Serov A. Y., Shtrom I. V., Bolshakov A. D. and Mukhin I. S.
CrystEngComm (IF: 3.269), 2020.

Hydrogen passivation of the n-GaN nanowire/p-Si heterointerface
Shugurov K. Yu., Mozharov A. M., Bolshakov A. D., Fedorov V. V., Sapunov G. A., Shtrom I. V., Uvarov A. V., Kudryashov D. A., Baranov A. I., Mikhailovskii V. Yu. and others
Nanomaterials (IF: 5.093), 2020.

Synthesis and optical characterization of GaAs epitaxial nanoparticles on silicon
Sapunov G. A., Fedorov V. V., Koval O. Y., Sharov V. A., Dvoretckaia L. N., Mukhin I. S. and Bolshakov A. D.
Crystal Growth & Design (IF: 4.089), 2019.

Effects of the surface preparation and buffer layer on the morphology, electronic and optical properties of the GaN nanowires on Si
Bolshakov A. D., Fedorov V. V., Shugurov K. Yu., Mozharov A. M., Sapunov G. A., Shtrom I. V., Mukhin M. S., Uvarov A. V., Cirlin G. E. and Mukhin I. S.
Nanotechnology (IF: 3.584), 2019.

Effective suppression of antiphase domains in GaP (N)/GaP heterostructures on Si(001)
Bolshakov A. D., Fedorov V. V., Koval O. Y., Sapunov G. A., Sobolev M. S., Pirogov E. V., Kirilenko D. A., Mozharov A. M. and Mukhin I. S.
Crystal Growth & Design (IF: 4.089), 2019.

Droplet epitaxy mediated growth of GaN nanostructures on Si(111) via plasma-assisted molecular beam epitaxy
Fedorov V. V., Bolshakov A. D., Kirilenko D. A., Mozharov A. M., Sitnikova A. A., Sapunov G. A., Dvoretckaia L. N., Shtrom I. V., Cirlin G. E. and Mukhin I. S.
CrystEngComm (IF: 3.269), 2018.

Dopant-stimulated growth of GaN nanotube-like nanostructures on Si(111) by molecular beam epitaxy
Bolshakov A. D., Mozharov A. M., Sapunov G. A., Shtrom I. V., Sibirev N. V., Fedorov V. V., Ubyivovk E. V., Tchernycheva M., Cirlin G. E. and Mukhin I. S.
Beilstein journal of nanotechnology (IF: 3.114), 2018.

Q2 Publications

Theoretical modeling of the self-catalyzed nanowire growth: nucleation- and adsorption-limited regimes
Bolshakov A. D., Mozharov A. M., Sapunov G. A., Fedorov V. V., Dvoretckaia L. N. and Mukhin I. S.
Materials Research Express (IF: 1.929), 2017.

Q3 Publications

Microlens-enhanced substrate patterning and MBE growth of GaP nanowires
Bolshakov A. D., Dvoretckaia L. N., Fedorov V. V., Sapunov G. A., Mozharov A. M., Shugurov K. Yu., Shkoldin V. A., Mukhin M. S., Cirlin G. E. and Mukhin I. S.
Semiconductors (IF: 0.674), 2018.

Self-catalyzed MBE-grown GaP nanowires on Si(111): V/III ratio effects on the morphology and crystal phase switching
Fedorov V. V., Bolshakov A. D., Dvoretckaia L. N., Sapunov G. A., Kirilenko D. A., Mozharov A. M., Shugurov K. Yu., Shkoldin V. A., Cirlin G. E. and Mukhin I. S.
Semiconductors (IF: 0.674), 2018.

Effect of the conductive channel cut-off on operation of n^+–n–n^+ GaN NW-based Gunn diode
Mozharov A. M., Vasiliev A. A., Komissarenko F. E., Bolshakov A. D., Sapunov G. A., Fedorov V. V., Cirlin G. E. and Mukhin I. S.
Semiconductors (IF: 0.674), 2018.

Core-shell III-nitride nanowire heterostructure: negative differential resistance and device application potential
Mozharov A. M., Vasiliev A. A., Bolshakov A. D., Sapunov G. A., Fedorov V. V., Cirlin G. E. and Mukhin I. S.
Semiconductors (IF: 0.674), 2018.

Q4 Publications

Self-consistent modeling of MBE self-catalyzed GaAs nanowire growth
Fedina S. V., Koryakin A. A., Fedorov V. V., Sapunov G. A., Mukhin I. S.
Journal of Physics: Conference Series (IF: 0.547), 2021.

Processes of formation of epitaxial arrays of self-catalytic GaP nanowires on Si (111)
Fedina S. V., Fedorov V. V., Berdnikov Y. S., Sapunov G. A., Mukhin I. S.
Journal of Physics: Conference Series (IF: 0.547), 2021.

Epitaxial synthesis of single-domain gallium phosphide on silicon
Sapunov G. A., Koval O. Yu., Fedorov V. V. and Bolshakov A. D.
Journal of Physics: Conference Series (IF: 0.547), 2020.

Controllable antiphase domain density in dilute nitride GaPN/GaP heterostructures on silicon
Fedorov V. V., Bolshakov A. D., Koval O. Yu., Sapunov G. A., Sobolev M, S., Pirogov E. V., Kirilenko D. A., Mozharov A. M., Mozharov A. M. and Mukhin I. S.
Journal of Physics: Conference Series (IF: 0.547), 2020.

Synthesis and characterization of GaPN/GaP heterostructures grown on silicon (001)
Koval O. Yu., Sapunov G. A. and Fedorov V. V.
Journal of Physics: Conference Series (IF: 0.547), 2020.

Conductive AFM study of the electronic properties of individual epitaxial GaN nanowires
Sharov V., Bolshakov A. D., Fedorov V. V., Shugurov K. Yu., Mozharov A. M., Sapunov G. A. and Mukhin I. S.
IOP Conference Series: Materials Science and Engineering, 2019.

Growth and optical properties of GaPN/GaP heterostructure nanowire array
Koval O. Yu., Sapunov G. A., Fedorov V. V. and Mukhin I. S.
Journal of Physics: Conference Series (IF: 0.547), 2019.

Synthesis and optical properties study of GaAs epitaxial nanoparticles on silicon

Sapunov G. A., Koval O. Yu., Sharov V., Dvoretckaia L. N., Mitin D. M. and Bolshakov A. D.

Journal of Physics: Conference Series (IF: 0.547), 2019.

GaN-nanowire/Si solar cell: numerical modeling, fabrication and characterization

Shugurov K. Yu., Mozharov A. M., Sapunov G. A., Fedorov V. V., Bolshakov A. D., Cirlin G. E. and Mukhin I. S.

Journal of Physics: Conference Series (IF: 0.547), 2019.

Influence of hydrogen plasma passivation on electrical and spectral characteristics of GaN nanowires/Si solar cells

Shugurov K. Yu., Mozharov A. M., Fedorov V. V., Bolshakov A. D., Sapunov G. A. and Mukhin I. S.

Journal of Physics: Conference Series (IF: 0.547), 2018.

GaN nanostructures grown on Si(111) by PA-MBE via droplet epitaxy: SEM and HRTEM study

Sapunov G. A., Fedorov V. V., Bolshakov A. D., Mozharov A. M., Dvoretckaia L. N., Kirilenko D. A., Sitnikova A. A. and Mukhin I. S.

Journal of Physics: Conference Series (IF: 0.547), 2018.

GaN nanowires on Si(111) substrates via molecular beam epitaxy: growth, electronic and optical properties

Bolshakov A. D., Fedorov V. V., Sapunov G. A., Mozharov A. M., Dvoretckaia L. N., Shugurov K. Yu., Shkoldin V, Shtrom I. V., Mukhin M. S., Cirlin G. E. and Mukhin I. S.

Journal of Physics: Conference Series (IF: 0.547), 2018.

Epitaxial GaN nanotripods: morphology and crystal structure

Sapunov G. A., Bolshakov A. D., Fedorov V. V., Mozharov A. M., Kirilenko D. A., Sitnikova A. A. and Mukhin I. S.

Journal of Physics: Conference Series (IF: 0.547), 2018.

Influence of interface layer preparation on the electrical and spectral characteristics of GaN/Si solar cells

Shugurov K. Yu., Mozharov A. M., Sapunov G. A., Fedorov V. V., Bolshakov A. D. and Mukhin I. S.

Journal of Physics: Conference Series (IF: 0.547), 2018.

Effect of Ga seeding layer on formation of epitaxial Y-shaped GaN nanoparticles on silicon

Fedorov V. V., Bolshakov A. D., Mozharov A. M., Sapunov G. A., Shtrom I. V., Kirilenko D. A., Sitnikova A. A. and Mukhin I. S.
Journal of Physics: Conference Series (IF: 0.547), 2017.

Modeling the semiconductor devices with negative differential resistance based on nitride nanowires
Mozharov A. M., Komissarenko F. E., Bolshakov A. D., Fedorov V. V., Sapunov G. A., Cirlin G. E. and Mukhin I. S.
Journal of Physics: Conference Series (IF: 0.547), 2017.

Synthesis of GaN nanowires on Si (111) substrates by molecular beam epitaxy
Bolshakov A. D., Sapunov G. A., Mozharov A. M., Cirlin G. E., Shtrom I. V., Mukhin I. S.
Journal of Physics: Conference Series (IF: 0.547), 2016.

Patent

Growth of GaN nanotubes activated by doping with Si on Si substrates with a thin AlN buffer layer 2020