



**INSTITUTE OF RADIATION PROBLEMS, MINISTRY OF SCIENCE AND  
EDUCATION REPUBLIC OF AZERBAIJAN  
FLEROV LABORATORY OF NUCLEAR REACTIONS AT THE JOINT INSTITUTE  
FOR NUCLEAR RESEARCH  
CIRRICULUM VITAE and PUBLICATION LIST**

## **Matlab N. Mirzayev**

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### ***PERSONAL INFORMATION***

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### ***PERSONAL STATEMENT***

My primary research focuses on the experimental nuclear physics such as the investigation of radiation effects and defects and positron annihilation lifetime spectroscopy in solids under different types of radiation conditions. I am particularly interested in understanding behaviors of the substances that are prominent materials

for radiation shielding against gamma, neutron, electron and ion irradiations. As an associate professor at Flerov Laboratory of Nuclear Reactions at the Joint Institute for Nuclear Research, I have gained precious experience in the nuclear topics such as shielding materials for nuclear applications, irradiation damage and analysis and studies of ion—radiation stability of microstructure, elemental and phase compositions. The scientific field of my researches connected with structure and phase state investigation of promising nanocomposite materials for nuclear applications. Pure boron compounds and boron-tungsten based composite materials were used in the experimental process that had been irradiated by alfa, neutrons, ions, and electron and flows of high-energy charged particles. My research area mainly focuses boron and tungsten alloys that are prominent materials due to their high melting point, low vapour pressure, very low sputtering erosion yields and high thermal conductivity for armour materials of plasma facing components. On the other hand, its limitations are associated with handling at low temperatures, plasma compatibility including neutron irradiation and radiological issues.

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## **EDUCATION**

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**09/2023 Doctor of science**

**Thesis Title:** THE EFFECTS OF HEAVY ION, NEUTRON AND IONIZING IRRADIATION ON THE STRUCTURAL CHANGES AND THERMOPHYSICAL PROPERTIES OF BORON BASED COMPOUNDS

**09/2019**

**Supreme Attestation Commission under the President of the Republic of Azerbaijan | Baku, Azerbaijan**

By the decision dated October 7, 2019 (Protocol 19-K) confers on Matlab N. Mirzayev the academic title of

**Associate Professor in the Specialty of Radiation Materials Science**

**01/2010 – 01/2014**

**Institute of Radiation Problems, Azerbaijan National Academy of Sciences| Baku, AZ1143 Azerbaijan**

**Ph.D:** Radiation material science, application and technology

**Thesis Title:** INFLUENCE OF INTERNAL AND EXTERNAL IRRADIATION ON ELECTROPHYSICAL PROPERTIES OF URANYL-SILICATE COMPOUNDS

**Degree:** Ph.D on Physics, Senior Scientist

**09/2005 – 07/2007**

**Baku State University, Faculty of Physics | Baku, AZ1143 Azerbaijan**

**MSc:** Division of Physics Education, Master Program, Faculty Physics of Solid State

**09/2001 – 07/2005**

**Baku State University, Faculty of Physics | Baku, AZ1143 Azerbaijan**

**BSc:** Division of Physics Education, Bachelor Program, Faculty Physics of Solid State

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## **EMPLOYMENT HISTORY**

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**01/09/2017 – Present**

**Associate Professor | Flerov Laboratory of Nuclear Reactions | at the Joint Institute for Nuclear Research.**

**Scientific and Experimental Physical Department:** Ion-implantation nanotechnology and radiation materials science

**Head of Department:** Vladimir Alexeevich SKURATOV, D.Sc.

**Dubna, Russia**

**01/09/2017 – 18/12/2014**

**Senior Scientist | National Nuclear Research Center, AZ1073, Inshaatchilar pr. 4, Baku, Azerbaijan**

**Division:** Department of Nanotechnology and Radiation Material Science

**Position:** Ph.D on Physics, Senior Scientist

In this period, I carried out studies on the following topics:

Determination of microstructure, elemental and phase states of the boron matrix composite under the radiation irradiation conditions. As shown in the below techniques:

- Scanning Electron Microscopy (SEM)
- X-Ray Diffraction (XRD)
- Raman Spectroscopy
- Small-Angle Neutron Scattering (SANS)
- Differential Scanning Calorimetry (DSC)
- Thermogravimetric analysis (TGA)

**06/05/2007 – 23/12/2014**

**Research Fellow | Institute of Radiation Problems, Azerbaijan National Academy of Sciences| Baku, AZ1143 Azerbaijan**

**Title of department:** Physics of radionuclide-containing materials.

**Position:** Researcher

I studied the topics as shown below during this period:

- Acquaintance with gamma irradiation technique and irradiation of composites by high-energy electrons.
- Electrophysical properties of boron composites irradiated by gamma and ions.
- Analysis and studies of ion—radiation stability of microstructure, elemental and phase compositions.
- Investigation of surface modifications and phase transformation of composite materials under the high gamma irradiation conditions.

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### ***ADDITIONAL SKILLS / RESEARCH INTEREST***

I have been working as a research assistant at the Flerov Laboratory of Nuclear Reactions at the Joint Institute for Nuclear Research since 2017. In the meantime, I also have some responsibilities to give lectures at the following laboratories.

- Radiation measurement techniques
- Positron annihilation lifetime spectroscopy XRF Analyses
- XRD Analyses
- SEM Analyses
- Energy-dispersive X-ray spectroscopy (EDS, EDX)
- The investigation on behaviour of soil samples against radiation
- Selection of tracer injection and sampling procedures
- Raman Spectroscopy
- Small Angle Neutron Scattering (SANS)
- Differential Scanning Calorimetry (DSC) Thermal Analysis.
- Thermogravimetric Analysis (TGA)

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## OTHER SKILLS

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- **IT: Good command of Microsoft office**

- Word, Excel, Power Point.
- Origin Pro
- Match 3
- Raman Tools

- **Languages:**

Azerbaijan (Fluent)

Turkish (Fluent)

English (Fluent)

Russian (Fluent)

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## PUBLICATIONS

1. M.N. Mirzayev, S.H.Jabarov, E.B.Asgerov, R.N.Mehdiyeva, T.T.Thabethe, S.Biira, N.V.Tiep, Crystal structure changes and weight kinetics of silicon-hexaboride under gamma irradiation dose, **Results in Physics**. 10 (2018) 541-545. DOI: [10.1016/j.rinp.2018.06.034](https://doi.org/10.1016/j.rinp.2018.06.034)
2. M.N. Mirzayev, Kh.F.Mammadov, R.G.Garibov, E.B.Askerov, Thermophysical properties of boron carbide irradiated by ionizing radiation, **High Temperature**, 56 (3) (2018) 374-377. DOI: [10.1134/S0018151X18030161](https://doi.org/10.1134/S0018151X18030161)
3. M.N. Mirzayev, R.N.Mehdiyeva, R.G.Garibov, N.A.Ismayilova, S.H. Jabarov, Influence of gamma irradiation on the surface morphology, XRD and thermophysical properties of silicide hexaboride, **Modern Physics Letters B**, 32(14) (2018) 1850151. DOI: [10.1142/S0217984918501518](https://doi.org/10.1142/S0217984918501518)
4. E.B. Asgerov, D.I. Ismailov, R.N. Mehdiyeva, S.H. Jabarov, M.N. Mirzayev, E.M. Kerimova, N.T.Dang, Differential-thermal and X-Ray analysis of TlFeS<sub>2</sub> and TlFeSe<sub>2</sub> chalcogenides, **Journal of Surface Investigation: X-ray, Synchrotron and Neutron Techniques**, 12(4) (2018) 688-691. DOI: [10.1134/S1027451018040043](https://doi.org/10.1134/S1027451018040043)
5. M.N. Mirzayev, R.N.Mehdiyeva, Kh.F.Mammadov, S.H.Jabarov, E.B.Asgerov, Calculation of the thermal parameters of boron silicide by differential scanning calorimetry, **Physics of Particles and Nuclei Letters (Physics of Solid State and Condensed Matter)**, 15(6) (2018) 673-677. DOI: [10.1134/S1547477118060146](https://doi.org/10.1134/S1547477118060146)
6. M.N. Mirzayev, R.N. Mehdiyeva, S.Z. Melikova, S.H. Jabarov, T.T. Thabethe, S. Biira, M.A. Kurbanov, N.V. Tiep, Formation of color centers and concentration of defects in boron carbide irradiated at low gamma radiation doses, **Journal of the Korean Physical Society**, 74(4) (2019) 363-367. DOI: [10.3938/jkps.74.363](https://doi.org/10.3938/jkps.74.363)
7. A.S. Alekperov, S. H. Jabarov, M.N. Mirzayev, E.B. Asgerov, N.A. Ismayilova, Y.I. Aliyev, T.T. Thabethe, N.T. Dang, Effect of gamma irradiation on microstructure of the layered Ge<sub>0.995</sub>Nd<sub>0.005</sub>S, **Modern Physics Letters B**, 33(09) (2019) 1950104. DOI: [10.1142/S0217984919501045](https://doi.org/10.1142/S0217984919501045)
8. M.N. Mirzayev, E.Demir, K.Mammadov, R.Mehdiyeva, S.Jabarov, A. B.Tuğrul, S.Biira, N.Tiep, T.Thabethe, Thermodynamics kinetics of boron carbide under gamma irradiation dose. **International Journal of Modern Physics B**. 33 (09) (2019) 1950073. <https://doi.org/10.1142/S0217979219500735>
9. M.Tashmetov, B.Abdurakhimov, M.N. Mirzayev, T.X. Thang, The effect of electron beam to nanocrystallites size, strain and structural parameters of the silicon carbide nanopowder, **International Journal of Modern Physics B**, 33(20) (2019) 1950223. <https://doi.org/10.1142/S0217979219502230>

10. E. Demir, Y. M. Gledenov, A. B. Tuğrul, M.N. Mirzayev, A.Kh. Islamov, V.A. Turchenko, O. Yılmaz, B. Büyük, E. Sansarbayar, M. L. Öveçoğlu Structural and morphological studies under small-angle neutron scattering of tungsten alloys. *Moscow University Physics Bulletin* 74(5) (2019) 509-513. <https://doi.org/10.3103/S0027134919050059>
11. R.F. Hashimov, F.A. Mikailzade, S.V. Trukhanov, N.M. Lyadov, I.R. Vakhitov, A.V. Trukhanov, M.N. Mirzayev, Structure and thermal analysis of Ba<sub>0.5</sub>La<sub>0.5</sub>MnO<sub>3</sub> polycrystalline powder, *International Journal of Modern Physics B*, 33(22) (2019) 1950244. [DOI: 10.1142/S0217979219502448](https://doi.org/10.1142/S0217979219502448)
12. M.N. Mirzayev, Kh.F. Mammadov, V.A. Skuratov, E. Demir, S.H. Jabarov, N.A. Ismayilova, S. Biira, B. Abdurakhimov, E. Popov, Oxidation kinetics and thermophysical properties of gamma irradiated silicon hexaboride. *Journal of Alloys and Compounds*, 801(15) (2019) 151-157. <https://doi.org/10.1016/j.jallcom.2019.06.135>
13. Mirzayev, M.N., Jabarov, S.H., Asgerov, E.B. et al. X-ray diffraction and thermodynamics kinetics of SiB<sub>6</sub> under gamma irradiation dose. *Silicon* 11(5) (2019) 2499–2504 <https://doi.org/10.1007/s12633-018-0039-2>
14. Y.I. Aliyev, P.R. Khalilzade, Y.G. Asadov, T.M. Ilyasli, F.M. Mammadov, N.A. Ismayilova, M.N. Mirzayev, S.H. Jabarov, N.T. Dang, Behavior of thermal properties of AgCu<sub>1-x</sub>Fe<sub>x</sub>S compounds under non-isothermal conditions, 33(28) (2019) 1950339. <https://doi.org/10.1142/S0217979219503399>
15. M.N. Mirzayev, B.A. Abdurakhimov, S.H. Jabarov, M.Yu. Tashmetov, E. Demir, N.V. Tjep, N.A. Ismayilova, Y.I. Aliyev, E. Popov, D.M. Mirzayeva, S.I. Karaaslan, G.I. Georgiev, Effect of high intense electron beam irradiation on structural and Raman properties of boron carbide micro powder, *International Journal of Modern Physics B*, 34 (04) (2020) 2050008. <https://doi.org/10.1142/S0217979220500083>.
16. M.N. Mirzayev, Oxidation kinetics of boron carbide ceramic under high gamma irradiation dose in the high temperature, *Ceramics International*, 46(3) (2019) 2816-2822. <https://doi.org/10.1016/j.ceramint.2019.09.273>
17. Y.I. Aliyev, Y.G. Asadov, T.M. Ilyasli, F.M. Mammadov, T.G. Naghiyev, Z.A. Ismayilova, M.N. Mirzayev, S.H. Jabarov, Structural aspects of thermal properties of AgCuS compound, 2020, *Modern Physics Letters B*, 34(05) (2020) 2050066. <https://doi.org/10.1142/S0217984920500669>
18. F.G. Agayev, S.H. Jabarov, G.Sh. Ayyubova, M.N. Mirzayev, S.V. Trukhanov, E.L. Trukhanova, M.A. Darwish, S.V. Podgornaya, D.A. Vinnik, T.P. Hoang, N.T. Dang, A.V. Trukhanov, Structure and thermal properties of BaFe<sub>11</sub>In<sub>0.9</sub>O<sub>19</sub> hexaferrite, *Physica B: Condensed Matter*, 580 (2020) 411772. <https://doi.org/10.1016/j.physb.2019.411772>
19. M.N. Mirzayev, Simultaneous measurements of heat flow rate and thermal properties of nano boron trioxide under neutron irradiation at the low and high temperature, *Vacuum* 173 (2020) 109162. <https://doi.org/10.1016/j.vacuum.2019.109162>
20. E.P. Popov, A.N. Chernikov, A.I. Beskrovnyi, J. Waliszewski, M.N. Mirzayev, Cryostat for cooling samples in the study of low-temperature structural and magnetic phase transitions by neutron diffraction, *Journal of Physics: Conference Series* 1492 (1) (2020) 012054. [DOI: 10.1088/1742-6596/1492/1/012054](https://doi.org/10.1088/1742-6596/1492/1/012054)
21. S.R. Azimova, N.M. Abdullayev, Y.I. Aliyev, M.N. Mirzayev, Effect of the Se-Te substitutions on thermal properties of binary Bi<sub>2</sub>Se<sub>3</sub> semiconductor, 34(15) (2020) 2050156. <https://doi.org/10.1142/S0217984920501560>
22. E. Demir, M.N. Mirzayev, A.B. Tuğrul, B.A. Abdurakhimov, S.I. Karaaslan, An experimental study on microstructure of tungsten alloys, *Surface Review and Letters*, 27 (07) (2020) 1950169. [DOI: 10.1142/S0218625X19501695](https://doi.org/10.1142/S0218625X19501695).
23. M.N. Mirzayev, High-flux neutron irradiation of boron trioxide analyzed with Raman and FTIR spectroscopy, *International Journal of Modern Physics B*, 34(18) (2020) 2050160. <https://doi.org/10.1142/S021797922050160X>.
24. V.A. Abdurahmanova, N.M. Abdullaev, S.S. Ismayilov, M.N. Mirzayev, The thermal properties of and SnSe and Sm<sub>1-x</sub>Ce<sub>x</sub>SnSe<sub>2</sub> compounds, *International Journal of Modern Physics B* 34 (18), 205016. <https://doi.org/10.1142/S0217979220501672>
25. S.R. Azimova, N.M. Abdullayev, Y.I. Aliyev, M.N. Mirzayev, V.A. Skuratov, A.K. Mutali, S.H. Jabarov, Study on the thermodynamic behavior of Sb-Te binary systems with swift heavy-



- ions irradiation at the high temperatures, *Journal of the Korean Physical Society*, 77 (3) (2020) 240-246. <https://doi.org/10.3938/jkps.77.240>.
26. F.G. Agayev, S.H. Jabarov, G.Sh. Ayyubova, A.V. Trukhanov, S.V. Trukhanov, M.N. Mirzayev, T.G. Naghiyev, N.T. Dang, Ferrimagnetic-paramagnetic phase transition in BaFe<sub>11.7</sub>In<sub>0.3</sub>O<sub>19</sub> compound, *Journal of Superconductivity and Novel Magnetism*, 33 (2020) 2867-2873. <https://doi.org/10.1007/s10948-020-05544-9>
  27. M.N. Mirzayev, E. Popov, E. Demir, B.A. Abdurakhimov, D.M. Mirzayeva, V.A. Sukratov, A.K. Mutali, V.N. Tiep, S. Biira, M.Yu. Tashmetov, K. Olejniczak, O. Kristavchuk, Thermophysical behavior of boron nitride and boron trioxide ceramics compounds with high energy electron fluence and swift heavy ion irradiated, *Journal of Alloys and Compounds*, 834 (2020)155119. <https://doi.org/10.1016/j.jallcom.2020.155119>.
  28. Mirzayev, M.N., Demir, E., Mammadov, K.F. et al. Amorphisation of boron carbide under gamma irradiation. *Journal of Physics*, 94 (2020) 110. <https://doi.org/10.1007/s12043-020-01980-3>
  29. M.N. Mirzayev, Study thermodynamic assessment of the B-C and B-Si binary systems with swift heavy ions and high intense electron beam irradiation at the low temperature, *Modern Physics Letters B*, 34(34) (2020) 2050395. <https://doi.org/10.1142/S0217984920503959>.
  30. E. Demir, M.N. Mirzayev, E.P. Popov, P. Horodek, I.G. Genov, K. Siemek, D.M. Mirzayeva, V.A. Turchenko, M. Bulavin, A.I. Beskrovnyi, A.H. Valizade, H.V. Akhundzada, S.I. Karaaslan, Effects of high-energetic <sup>3</sup>He<sup>+</sup> ion irradiation on tungsten-based composites, *Vacuum*, 184 (2021) 109934. <https://doi.org/10.1016/j.vacuum.2020.109934>
  31. Matlab N. Mirzayev, Heat transfer of hexagonal boron nitride (h-BN) compound up to 1 MeV neutron energy: Kinetics of the release of wigner energy, *Radiation Physics and Chemistry*, 180 (2021) 109244. <https://doi.org/10.1016/j.radphyschem.2020.109244>
  32. M.N. Mirzayev, B.A. Abdurakhimov, E. Demir, A.A. Donkov, E. Popov, M.Yu. Tashmetov, I.G. Genov, T.T. Thabethe, K. Siemek, K. Krezhov, F. Mamedov, D.M. Mirzayeva, M.V. Bulavin, V.A. Turchenko, T.X. Thang, T.Z. Abdurakhmonov, P. Horodek, Investigation of the formation of defects under fast neutrons and gamma irradiation in 3C-SiC nano powder, *Physica B: Condensed Matter.*, 611 (2021) 412842. <https://doi.org/10.1016/j.physb.2021.412842>
  33. V.Yu. Goroneskul Yu.Yu. Bacherikov, M.N. Mirzayev, A.G. Zhuk, O.B. Okhrimenko, N.V. Doroshkevich, V.V. Kidalov, Preparation of quaternary compounds Cu<sub>2</sub>ZnSnS<sub>4</sub> by using the self-propagating high-temperature synthesis, *Semiconductor Physics, Quantum Electronics & Optoelectronics*, 24 (3) (2021) 272-276.
  34. S.H. Jabarov, Y.I. Aliyev, T.M. Ilyasli, A.A. Baylarova, A.O. Dashdemirov, V.I. Nasirov, N.A. Ismayilova, G.M. Aghamirzayeva, M.N. Mirzayev, AgCuS compound as a thermodynamic system under the influence of gamma rays, *Integrated Ferroelectrics*, 221 (1) (2021) 180-185. <https://doi.org/10.1080/10584587.2021.1965843>
  35. F.G. Agayev, A.V. Trukhanov, S.V. Trukhanov, S.H. Jabarov, E.L. Trukhanova, G.Sh. Ayyubova, M.N. Mirzayev, D.A. Vinnik, A.L. Kozlovskiy, M.V. Zdorovets, A.S.B. Sombra, Di. Zhou, R.B. Jotania, C. Singh, An.V. Trukhanov, Crystal structure, magnetic properties and thermal behavior of BaFe<sub>11.9</sub>In<sub>0.1</sub>O<sub>19</sub> ferrite, *Physica Status Solidi (b)*, 259(10) (2022) 2100655. <https://doi.org/10.1002/pssb.202100655>
  36. A.S. Doroshkevich, A.S. Zakharova, B.L. Oksengendler, A.I. Lyubchik, S.I. Lyubchik, S.B. Lyubchik, A.A. Tatarinova, A.K. Kirillov, T.A. Vasilenko, O.O. Gorban, V.I. Bodnarchuk, N.N. Nikiforova, E.A. Zakharova, M.Balasoiiu, D.M. Mardare, C.Mita, A.Stanculescu, M.N. Mirzayev, A.A. Nabiyev, E.P. Popov, L.H. Khiem, A.A. Donkov, V.Teofilović, B. Jasinska, D.Chicea, T.Y. Konstantinova, The Rectifying contact of hydrated different size YSZ nanoparticles for advanced electronics, *Nanomaterials*, 12(24) (2022) 4493. <https://doi.org/10.3390/nano12244493>
  37. P.Horodek, K. Siemek, M.N. Mirzayev, E.P. Popov, A.A. Donkov, M. Kulik, M. Turek, M. Bielewicz, Variable energy positron beam studies of gold exposed to Au<sup>+</sup> and H<sup>+</sup> implantation, *Acta Physica Polonica A*, 142(6) (2023) 702-706. [Doi:10.12693/APhysPolA.142.702](https://doi.org/10.12693/APhysPolA.142.702)

38. Matlab N Mirzayev et al., Effects of neutron irradiation at different fluencies on nanosized anatase titanium dioxide, *Radiation Physics and Chemistry*, 194 (2022) 109988. <https://doi.org/10.1016/j.radphyschem.2022.109988>
39. A.S. Doroshkevich, A.I. Lyubchik, B.L. Oksengendler, T.Yu. Zelenyak, N.O. Appazov, A. K. Kirillov, T.A. Vasilenko, A.A. Tatarinova, O.O. Gorban, V.I. Bodnarchuk, N.N. Nikiforova, M.Balasoiu, D.M. Mardare, C.Mita, D.Luca, M.N. Mirzayev, A.A. Nabiyeu, E.P. Popov, A. Stanculescu, T.E. Konstantinova, Y.V. Aleksiyenak, Electric energy storage effect in hydrated ZrO<sub>2</sub>-nanostructured system, *Nanomaterials*, 12(11) (2022) 1783. <https://doi.org/10.3390/nano12111783>
40. D. Neov, L. Slavov, A.A. Donkov, M.N. Mirzayev, E. Popov, E. Demir, K. Siemek, N. Djourelou, V.A. Turchenko, Z.A. Sharipov, P. Horodek, A.I. Beskrovnyi, A.H. Valizade, O.A. Samedov, A. Vladescu, K. Krezhov, I. Felicia, Structural study of W<sub>2</sub>B obtained via mechanical alloying of W, B<sub>4</sub>C, TiC and graphite before and after He ions irradiation, *Nuclear Materials and Energy*, 31 (2022) 101201. <https://doi.org/10.1016/j.nme.2022.101201>
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