

ISSN 2312-3001

# Journal of Radiation Researches

Azerbaijan National Academy of Sciences  
Institute of Radiation Problems



---

**Volume 5, No.2**  
**2018**  
**Baku**

Published from 2014 twice a year  
Ministry of Justice of Azerbaijan Republic,  
Registration number 3858, 14.02.2014

---

*"Journal of Radiation Researches"* has been included in the list of scientific periodicals recommended for the publication of main results of the dissertations in the Republic of Azerbaijan by the decision of the Supreme Attestation Commission under the President of the Republic of Azerbaijan.

**(Meeting dated 31.03.2017, Protocol No. 6-R)**

---

**Publishing office:** AZ1143, The Republic of Azerbaijan, Baku c., B.Vahabzadeh str., 9

Institute of Radiation Problems of ANAS

**Tel:** (+994 12) 538 32 24;

**Fax:** (+994 12) 539 83 18

**Web-site:** <http://irp.science.az>

**E-mail:** [interproj-irp@yandex.ru](mailto:interproj-irp@yandex.ru)

Number of copies: 100

The journal has been published by "Elm" publishing house of ANAS.

## **EDITOR-IN-CHIEF**

Ogtay Samadov – Corr. memb. of ANAS., Institute of Radiation Problems, ANAS

## **SENIOR EDITOR**

Ibrahim Gabulov – Candidate of physical and mathematical sciences, Institute of Radiation Problems, ANAS

Javid Huseynov – editorial assistant, Institute of Radiation Problems, ANAS

## **INTERNATIONAL REVIEW BOARD**

Alexander Yermakov – Prof., Dr. in chemistry, Institute of Energetic Problems of Chemical Physics, Russian Academy of Sciences, Russia

Andrzej Chmielewski – Prof., Institute of Nuclear Chemistry and Technology, Warsaw, Poland

Arif Maharramov – Prof., Dr. in phys.-math., IRP, ANAS, Azerbaijan

Elmkhan Jafarov – Dr. in biol., IRP, ANAS, Azerbaijan

Fadey Komarov – Corr. memb. of NAS of Belarus, Scientific-Research Institute for Applied Physical Problems, Belarus State University, Belarus.

Islam Mustafayev – Corr. memb. of ANAS, IRP, ANAS, Azerbaijan

Mahmud Abdullayev – Corr. memb. of ANAS, IRP, ANAS, Azerbaijan

Mikhail Bondarkov – Prof., International Radioecological Laboratory, Chernobyl Center, Ukraine

Muslum Gurbanov – Prof., Dr. in chem., IRP, ANAS, Azerbaijan

Namik Rashydov – Dr. in biol., NAS of Ukraine, Ukraine

Rahim Madatov – Prof., Dr. in phys.-math., IRP, ANAS, Azerbaijan

Rauf Sardarli – Prof., Dr. in phys.-math., IRP, ANAS, Azerbaijan

Ravan Mehdiyeva – Assoc. prof., PhD in phys.-math., IRP, ANAS, Azerbaijan

Robert Ilyasov - Prof. Dr. in Biol., Corr.Memb. AN RF

Sajida Abdulvahabova – Prof., Dr. in phys.-math., Baku State University, Azerbaijan

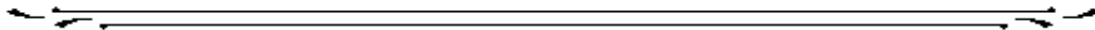
Shakir Nagiyev – Prof., Dr. in phys.-math., IP, ANAS, Azerbaijan

Vali Huseynov – Corr. memb.of ANAS, Supreme Attestation Commission under the president of Azerbaijan Republic

Vladimir Fateev – Prof., Director of Hydrogen Energy and Plasma Technology Institute of RRC “Kurchatov Institute”, Russia

## INSTRUCTION FOR AUTHORS

1. The Journal of Radiation Researches accepts original unpublished articles and book reviews in the following **fields**: - radiation research and its practical aspects, peaceful use of nuclear energy, nuclear physics, nuclear and radiation safety, radiochemistry, radiobiology, radioecology, application of nuclear and radiation technologies and methods, acquire and use of nuclear knowledge.
2. Articles should be written in English.
3. The article should be sent in the CD together with the signed statement or to the electronic mail ([interproj-irp@yandex.ru](mailto:interproj-irp@yandex.ru)). The submitted article should follow the following: article title, author's name, address, abstract, key words, text including the results of the research and its significance and reference.
4. **File format** should be compatible with Microsoft Word format in Times New Roman. The margins sizes of the page: - top 3cm, bottom 3sm, left 3sm, right 1.5sm. Main text should be written in 12 point type size, single spaced. Articles should be submitted in triplicate, should be written in 12 point type size and typed on one side of A4 while article. The article title should be centered on the page and in bold capitals. The writer's name should be centered on the page under the article title with one space between the two, followed by the author's email.
5. The maximum number of pages for an article should not exceed 10 pages.
6. **The abstract** should be written in English, Russian and Azerbaijani languages in 11 point type size, between 100 and 150 words. The abstract of the article should correspond to the context of the article. The conclusion of the research, innovation and practical importance of the article should briefly be noted in the abstract by the author (s). In the abstract, the name of the article and the full name(s) of the author(s) should be written clearly.
7. **The keywords** should not be more than six words.
8. **PACS** alphabetical index should be used in the article.
9. **Figures, pictures, graphics and tables** must be of publishing quality and inside the text. Figures, pictures and graphics should be captioned underneath, tables should be captioned above.
10. **References** should be given in square brackets in the text and listed according to the order inside the text at the end of the article. Where applicable, author(s) name(s), journal title/book title, chapter title/article title, year of publication, volume number/book chapter and the pagination must be present.
11. The decision to publish a given article is made by the international review board of the journal through recommendations taken from referees. The referees may ask the author of the article to make amendments to the article prior to publication.





**Azerbaijan National Academy of Sciences Presidium, Division of  
Physical Mathematical and Technical  
Sciences  
Institute of Radiation Problems of ANAS**

# **RADIATION PROCESSES AND THEIR APPLICATIONS**

## **INTERNATIONAL CONFERENCE**

**dedicated to the 70th Anniversary of Academician M.K. Karimov**



**BAKU, AZERBAIJAN**

**November 13-14, 2018**

## ***ORGANIZING COMMITTEE***

***Chairman:*** Academician Akif Alizadeh  
***Co-Chairman:*** Academician Nazim Mammadov  
***Vice-Chairman:*** Corres. memb. of ANAS Ogtay Samadov

Academician Rasim Aliguliyev  
Academician Arif Hashimov  
Academician Javad Abdinov  
Academician Abel Maharramov  
Academician Adil Qaribov  
Corres. memb. of ANAS Aydin Kazimzadeh

## ***EDITORIAL BOARD***

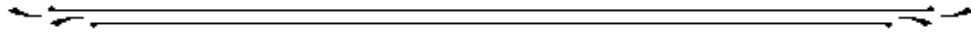
Ravan Mehdiyeva, Assoc. prof., Ph.D  
İslam Mustafayev, Corres. memb. of ANAS  
Mahmud Abdullayev, Corres. memb. of ANAS  
Rauf Sardarli, Prof., Dr. in phys.-math.  
Rahim Madatov, Prof., Dr. in phys.-math,  
Muslum Gurbanov, Prof., Dr. in chem.  
Arif Maharramov, Prof., Dr. in phys.-math.  
Elmkhan Jafarov, Prof., Dr. in biol.  
Chingiz Aliyev, Corres. memb. of ANAS  
Famin Salmanov, Ph.D  
Bahruz Suleymanov, Ph.D

***Scientific Secretary:*** M. Mehrabova, Assoc. prof., Dr. in physics

---

## ***CONFERENCE TOPICS***

1. Radiation study of materials (including liquid and gas medium)
2. Radiation safety, radioecology and ecologically pure energetics
3. Application of radiation technologies in medicine and to solve environmental problems



## Prominent scientist, proficient science organizer

Our eminent personalities, promoting the science, culture and art of our people around the world and bringing honour and glory to Azerbaijan existed in the past and now they also exist. From this view point, XX and XXI centuries are not an exception. We are honoured and proud of our outstanding contemporaries having worldwide fame. The former president of ANAS, Academician Mahmud Karimov is one of the prominent representatives of the Azerbaijan science, who provided special services for his scientific, organizational and social activities in the development of national, intellectual thought, based on modern criteria and principles.

Academician M.K. Karimov was born on October 18, 1948 in Yerevan, Armenia, in the family of prominent Azerbaijani scientist, correspondent member of ANAS, Karim Karimov.

In 1971 he graduated from the Department of Physics of Baku State University. In 1971-1973 served as a platoon commander (senior lieutenant) in the Soviet Army.

Mahmud Karimov has been working as an engineer at the Institute of Physics since 1973. From 1974 to 1984, he worked as a laboratory assistant in the Radiation Research Sector and became the director of that sector in 2001. Mahmud Karimov, who was elected president of ANAS in 2001, worked on this post until his death. Mahmud Karimov has always been a high-profile citizen of Azerbaijan in terms of social and cultural events in the country.

In 1979, he defended his PhD thesis, in 2000 got a professor title, in 2001 was elected as an active member and president of ANAS. In 1998 he was awarded with the honorary decree of ANAS in the connection with his 50th jubilee.

5 years past since academician M.K. Karimov died, and if he were alive, this year he would be 70 years old. He has dedicated 30 years of his life to the Institute of Radiation Problems of ANAS, has been the director of the Institute for 17 years. M.K. Karimov, who published his first scientific article in the journal of "Оптика и спектроскопия" at the USSR Academy of Sciences, for the first time, has investigated elemental electron and molecular processes that occur under the influence of a strong electric field in polymer dielectrics and it, in its turn, led to the controlling the properties of material by electric field and the clarifying the electric wear mechanism of polymer dielectrics.

The thermoluminescence effect stimulated by the electric field, discovered by M.K. Karimov is of great importance in detecting the molecular dynamics and the energetic characteristics of different states in polymers. Thus, this effect allowed defining the impact of the electric field on the distribution of localized charges according to the energy levels in the polymers.

The spin-probe diagnostics method of strong local electric fields areas in polymer dielectrics, created by M.K. Karimov is of great importance in predicting the durability of polymer insulators and in the investigation of the formation and collection process of volume charges in them.

The results of his research on the free radical processes induced by the electric field in polymer dielectrics allowed detecting the mechanism of elemental destructivity occurred under the influence of a strong electric field, and determining the role of free radicals in the modification of structure and properties of polymers. The electric field effect in the photogeneration of macroradicals, determined by M.K. Karimov leads to the regulation of the physical and chemical properties of the materials and to the control of photoprocesses in polymer materials by the external electric field. The results obtained from the study of electroluminescence in polymers are of practical importance. These results allowed for the first time to coordinate the macrokinetics of the electrical dispersion of polymer dielectrics with elementary microprocesses.



The researches of M.K. Karimov on the role of molecular dynamics in the kinetics and mechanism of electrical dispersion in polymers are of particular importance. The development of microdischarges controlled by molecular dynamics, which is revealed for the first time, in the electric-charged polymers and light scattering regularities confirm their close relationship with relaxation process. These studies form the basis of the distribution of the relaxation processes and molecular movements according to the dynamic and activation parameters.

One aspect of M.K. Karimov's researches is the study of electrical, magnetic and optical properties of polymers and molecular semiconductors. The molecular semiconductor thin films obtained by him on the basis of plasmopolymers have active photoelectric properties, as well as they are applied as sensitive gas sensors.

It should be especially mentioned his researches on the detection of interaction of paramagnetism and electroconductivity in molecular semiconductors based on polydiacetylene. A number of original results have been obtained from the study of the interactions between localized paramagnetic centers system and the delocalized systems of the charge carriers. Specifically, it has been revealed the spin-magnetic effects of polydiacetylene in electroconductivity and the extremely fine structure in the magnetic resonance conductivity, and investigated for the first time the transfer processes of magnetic excitation energy from the spin system of charge carriers to localized paramagnetic centers.

One of the most important places in M.K. Karimov's creativity is the study of the mechanism and kinetics of the formation of point defects in oxide dielectrics by the influence of radiation and electric field. These studies are closely related to the actual problems, such as the transformation of radiation energy into chemical energy in the radiation and plasma catalytic decomposition processes of water. Based on these studies, the effective methods of the obtaining hydrogen from the water are proposed.

M.K. Karimov, a highly qualified specialist in the field of electron paramagnetic resonance, successfully applied this research method to the solution of various problems in physics, chemistry and biology. His numerous scientific works and copyright certificates confirm it.

Academician M.K. Karimov was also engaged in the study of the effects of ionizing radiation on various types of solids. The changes occurred in the physical and physico-chemical properties of semiconductor, polymer, dielectric substances under the influence of these rays and their regularities have been complexly studied. It has been studied the effects of accelerated electrons on semiconductor materials and devices (diode, transistor, etc.), the problems of radiation resistance of devices operating under the effects of space spatial factors. Under the leadership of M.K. Karimov, the significant results have been achieved in the field of obtaining semiconductor and dielectric materials having necessary properties and resistant to the effects of ionizing radiation on the problem of radiation physics of semiconductors and dielectrics. These materials played an important role in the development of information technologies.

After the independence of our country, important changes occurred in the direction of academician Karimov's scientific issues, as well as in the field of international cooperation and relations. In contrast to the previous periods, his research direction is primarily focused on the interests of our country. Under his leadership and with the support of the USA CRDF, the "Project of development of physical environment research center" was implemented. The laboratory of "Physics and chemistry of harmful factors effecting the environment" was created at the Institute of Radiation Problems of ANAS. The laboratory was equipped with the most advanced equipment for the solution of scientific and scientific-technical problems in the field of nuclear and radiation safety and got the International ISO certificate in 2006. In this laboratory, the fundamental scientific and technical studies have been carried out in the direction of radiation

safety, radioecology, radiation effects on solid objects and radiation material science, under the leadership of academician M.K. Karimov. The significant results have been achieved in the field of monitoring of heavy metals, radionuclides and persistent organic compounds in Kura-Aras Rivers and studying the transportation and transformation processes of radium isotopes, polycyclic and heavy metal compounds in the field of the use of oil-gas. Great scientist has made a great contribution to the science policy of Azerbaijan during his leadership, and our science has entered a new phase of development. This prominent science organizer has contributed to the rapid integration of Azerbaijani science into the world science structures and to a significant expansion of relations in foreign countries.

After a long break, the series of Physical-Mathematical and Technical Sciences of the "Xəbərlər" journal of ANAS was published in the initiative of M. Karimov.

M.K. Karimov has been the author of more than 260 scientific works and inventions, many of which have been published in scientific journals of former USSR, Russia and other foreign countries. He has regularly participated in scientific conferences, symposia and seminars. There are numerous references to his scientific results in the literature, and quotes from his scientific researches in some monographs. (Л.А.Грибов "Теория инфракрасных спектров полимеров", М., "Наука", 1977; Н.М.Эмануэль, А.Л.Бучаченко "Химическая физика старения и стабилизации полимеров", М., "Наука", 1982; А.П.Тютнев, А.В.Ванников "Электрические явления при облучении полимеров", М., "ЭНЕРГОАТОМИЗДАТ", 1985).

Academician M.K. Karimov's activities as a scientist, public figure, tireless organizer of scientific work were many-branched and comprehensive. He was an authorized representative of Azerbaijan at the United Nuclear Research Institute (Dubna), an honorary member of the Georgian and Kazakhstan National Academy of Sciences, a chairman of the Scientific coordination and Technology councils, a member of the Presidents Council of the Black Sea Economic Cooperation Academies. He was also a member of the Heydar Aliyev Prize, Education, Heraldic Commission, Board of Trustees of the Heydar Aliyev Foundation, and the State Oil Fund's Supervisory Council. Every year academician M.K. Karimov has been worthily representing Azerbaijan in influential international organizations, such as IAEA, NATO, and UNESCO. As a Chairman of the Board of the World Azerbaijanis Coordinating Council, he successfully implemented the strategic line of Mr. Heydar Aliyev, the national leader in this direction.

The scientific and scientific-organizational activity of the late academician was highly appreciated by our state. He was awarded by the "Glory" order for his contribution to the development of Azerbaijani science.

The rich scientific heritage of Mahmud Karimov, devoted to the development of science in Azerbaijan for 40 years, will always be a source for future generations. His spiritual qualities will always be in the hearts of scientists.

Corresponding member of ANAS Ogtay Samadov