Atomic and Nuclear Chemistry

In this highly interesting book, three pioneering investigators provide an account of the discovery and investigation of the nuclear and chemical properties of the twenty presently known transuranium elements. The neutron irradiation of uranium led to the discovery of nuclear fission in 1938 and then to the first transuranium element, neptunium (atomic number 93), in 1940. Plutonium (94) quickly followed and the next nine elements completed the actinide series by 1961. Investigation of the chemical properties of the actinides was followed more recently by chemical studies of the first three transactinides — rutherfordium (104), hahnium (105), and seaborgium (106). Recent discoveries have extended the known elements to 112. Contents: Neptunium and Plutonium The Plutonium PeopleAmericium and CuriumBerkelium and Californium The Big Bang: Discovery of Einsteinium and FermiumMendeleviumNobelium and LawrenciumRutherfordium and HahniumSeaborgiumBohrium (107), Hassium (108), and Meitnerium (109)Elements 110, 111, and 112Naming Controversies and the Transfermium Working GroupSearches for the Superheavy ElementsReflections and Predictions Readership: Undergraduates and graduates in nuclear physics, radiochemistry and the general readers. Keywords: Transuranium PeopleNeptunium;Transactinides;Rutherfordium;Hahnium;Seaborgium Reviews: ‘The Transuranium People’ is a splendid tribute to those who have made the past 60 years a golden age for discovering new elements.” C&EN

Handbook of Nuclear Chemistry

The first book for advanced students of chemistry and chemical engineering to cover both basic nuclear chemistry and the whole nuclear power fuel cycle including waste handling and storage and associated hazards. Covers all major advances in the field up to 1978. Includes problems and solutions. The book has been course tested at Chalmers University of Technology, Sweden

Analytical Applications of Nuclear Techniques

Scientific Opportunities with a Rare-Isotope Facility in the United States

Nuclear energy is the only realistic substitute to the environment-unfriendly energy production based on fossil fuels. With presenting safe and effective nuclear reactors of new generations, nuclear power regains its position pointed by the Chernobyl accident. Radiochemistry, radiation chemistry and nuclear chemical engineering play a vital role in the nuclear power development. Even at present, the accessible technology is well developed, but still several improvements are needed and proposed. These developments deal with all stages of the technology; front end, reactor operation (coolant chemistry and installation components decontamination, noble gas release control), back end of fuel cycle, etc. A large number of different research activities related to nuclear chemistry, nuclear fission, spectroscopic investigations, development of radio analytical techniques and other analytical methodologies for chemical quality control (CQC) of nuclear fuel materials, process chemistry of actinides, spectroscopic and X-ray studies, mass spectrometry, thermodynamic investigations, recovery of actinides from analytical waste solutions and post irradiation studies on irradiated nuclear fuel were undertaken. Nuclear And Radiochemistry brings together innovative research and trends on nuclear and radiochemistry in a well-structured manner dealing with the theory and real cases followed by chapters devoted to such specific topics as nuclear energy and reactors, radiotracers, and radionuclides. It illustrates a role of chemistry for a safe and economical nuclear power development. This book will be of valuable resource for newcomers and various experts such as, radiochemists, metallurgists, reactor physicists and fuel designers as well as established scientists in the field.

Source Material for Radiochemistry

Principles of Nuclear Chemistry is an introductory text in nuclear chemistry and radiochemistry, aimed at undergraduates with little or no knowledge of physics. It covers the key aspects of modern nuclear chemistry and includes worked solutions to end of chapter questions. The text begins with basic theories in contemporary physics and uses these to introduce some fundamental mathematical techniques. It relates nuclear phenomena to key divisions of chemistry such as atomic structure, spectroscopy, equilibria and kinetics. It also gives an introduction to f-block chemistry and the nuclear power industry. This book is essential reading for those taking a first course in nuclear chemistry and is a useful companion to other volumes in
physical and analytical chemistry. It will also be of use to those new to working in nuclear chemistry or radiochemistry.

**Principles of Nuclear Chemistry**

Nuclear chemistry comprises isotope chemistry, radiochemistry, radiation chemistry and nuclear reaction chemistry, along with applications. These interrelated fields are all covered in this textbook for chemists and chemical engineers. This new edition of the standard work 'Nuclear Chemistry' has been completely rewritten and restructured to suit teaching and learning needs in a wide range of chemistry courses, such as basic courses in radiochemistry, or more advanced nuclear chemistry courses. The book is divided into sections that closely fit teaching demands. The first chapter gives a broad introduction and background to the subject, and the second chapter covers stable isotopes. Chapters 3 to 9 comprise what is generally regarded as 'radiochemistry'. Chapters 10 to 17 offer a course in nuclear reaction chemistry. Chapter 18 deals with biological radiation effects for the chemist. The last four chapters give a guide to nuclear energy: energy production, fuel cycle, waste management, the largest applied field of nuclear chemistry. Over 200 exercises, with model answers, remain largely unchanged from the first edition, so teachers working from the earlier text should find only advantages in switching to this new restructured course book on all aspects of nuclear chemistry. 'The book fully meets the authors objectives, it is well written in a logical, objective, thought-provoking and quite easily readable style. It should appeal to the serious student of radio- and nuclear chemistry at either undergraduate or postgraduate level, as well as to readers with a more general interest in nuclear science and its impact on the environment.' - Applied Radiation and Isotopes, July 1995 'This book is an excellent, readable account of a significant part of the scientific achievements of more than half this century. The authors have dedicated the book to Nobel Laureate Glenn T. Seaborg and its scholarship makes it a fitting tribute.' - Radiological Protection Bulletin, December 1995

**Assuring a Future U.S.-Based Nuclear and Radiochemistry Expertise**

Modern Nuclear Chemistry provides up-to-date coverage of the latest research as well as examinations of the theoretical and practical aspects of nuclear and radiochemistry. Includes worked examples and solved problems. Provides comprehensive information as a practical reference. Presents fundamental physical principles, in brief, of nuclear and radiochemistry.

**Fundamentals of Radiochemistry**

**Radiochemical Analysis**

The second edition of Modern Nuclear Chemistry provides succinct coverage of basic physical principles of nuclear and radiochemistry bringing together a detailed, rigorous perspective on both the theoretical and practical aspects of this rapidly evolving field.

**Nuclear and Radiochemistry**

**Nuclear Chemistry**

The growing use of nuclear medicine, the potential expansion of nuclear power generation, and the urgent needs to protect the nation against external nuclear threats, to maintain our nuclear weapons stockpile, and to manage the nuclear wastes generated in past decades, require a substantial, highly trained, and exceptionally talented workforce. Assuring a Future U.S.-Based Nuclear and Radiochemistry Expertise examines supply and demand for expertise in nuclear chemistry nuclear science, and radiochemistry in the United States and presents possible approaches for ensuring adequate availability of these skills, including necessary science and technology training programs. Considering a range of reasonable scenarios looking to the future, none of these areas are likely to experience a decrease in demand for expertise. However, many in the current workforce are approaching retirement age and the number of students opting for careers in nuclear and radiochemistry has decreased dramatically over the past few decades. In order to avoid a gap in these critical areas, increases in student interest in these careers, in the research and educational capacity of universities and colleges, and sector specific on-the-job training will be needed. Concise recommendations are given for actions to avoid a shortage of nuclear chemistry, nuclear scientists, and radiochemists in the future.

**Handbook of nuclear chemistry**

Nanoparticles may be used in industrial processes, incorporated into consumer products, or applied as biomedical agents. Isotopic (radio)labeling is one of the most powerful methods for nanoparticle tracing in experimental studies. This book presents an introduction to some commonly used nanomaterials, describes various methods with which they may be radiolabeled, and provides illustrative examples of applications of the labeled particles. Finally, it discusses the use of nanomaterials in radiotherapy, the stable isotope labeling technique, and operational health and safety aspects related to the manipulation of nanoparticles in controlled areas. The book will appeal to anyone involved in nanotechnology, molecular imaging, radiochemistry, and nanomedicine.

**Nuclear Chemistry and Its Applications**

**Introduction to Nuclear Reactions**

Concentrating on techniques for the detection and measurement of radioactivity, this book is an important guide to radiation. The author highlights key differences between an ordinary chemical laboratory and a radiochemical one and builds a foundation for this type of study.
Atomic and Nuclear Chemistry

This text on radiation chemistry covers a number of topics, including the development of radiation chemistry, sources of high-energy radiation, dosimetry, organic materials and solids and the applications of high-energy radiation in chemical synthesis and in commercial processes.

Nuclear and Radiochemistry

The past decade has seen a remarkable growth in the extent and variety of experiments being done on nuclear reactions. The purpose of this book is to understand the results of the measurements gained in these experiments rather than to describe how they are made.

Nuclear Chemistry

The third edition of this classic in the field is completely updated and revised with approximately 30% new content so as to include the latest developments. The handbook and ready reference comprehensively covers nuclear and radiochemistry in a well-structured and readily accessible manner, dealing with the theory and fundamentals in the first half, followed by chapters devoted to such specific topics as nuclear energy and reactors, radiotracers, and radionuclides in the life sciences. The result is a valuable resource for both newcomers as well as established scientists in the field.


Fundamentals of Radiochemistry presents a comprehensive overview of the principles, objectives, and methods of radiochemistry and how they are applied in various fields of chemistry. Topics covered include characteristics of radioactivity and radioactive matter, the chemistry of ephemeral radionuclides, actinides of high atomic number, positronium, and physicochemical behavior of systems containing one or more compounds at tracer or sub-tracer concentration. Numerous appendices are included to provide additional detail to information presented in chapters. Because Fundamentals of Radiochemistry is the first book to discuss what chemical information can be obtained with sub-tracer amounts, it is essential reading for inorganic chemists, radiochemists, analytical chemists, nuclear chemists and others interested in the topic.

Atomic Forensic Analysis, Second Edition

Now in its second edition, Nuclear Forensic Analysis provides a multidisciplinary reference for forensic scientists, analytical and nuclear chemists, and nuclear physicists in one convenient source. The authors focus particularly on the chemical, physical, and nuclear aspects associated with the production or interrogation of a radioactive sample. They consolidate fundamental principles of nuclear forensic analysis, all pertinent protocols and procedures, computer modeling development, interpretational insights, and attribution considerations. The principles and techniques detailed are then demonstrated and discussed in their applications to real-world investigations and casework conducted over the past several years. Highlights of the Second Edition include: A new section on sample analysis considerations and interpretation following a post-detonation nuclear forensic collection New case studies, including the most wide-ranging and multidisciplinary nuclear forensic investigation conducted by Lawrence Livermore National Laboratory to date Expanded treatments of radiologic dispersal devices (RDDs) and statistical analysis methodologies The material is presented with minimal mathematical formality, using consistent terminology with limited jargon, making it a reliable, accessible reference. The broad-based coverage provides important insight into the multifaceted changes facing this recently developed science.

Radiochemistry and Nuclear Chemistry

This book provides a primary reference source for nuclear forensic science, including the vastly disciplinary nature of the overall endeavor for questioned weapons of mass-destruction specimens. Nothing like this exists even in the classified material. For the first time, the fundamental principles of radioforensic analysis, all pertinent protocols and procedures, computer modeling development, interpretational insights, and attribution considerations are consolidated into one convenient source. The principles and techniques so developed are then demonstrated and discussed in their applications to real-world investigations and casework conducted over the past several years.

Essentials of Nuclear Chemistry

Nuclear chemistry comprises isotope chemistry, radiochemistry, radiation chemistry and nuclear reaction chemistry, along with applications. These interrelated fields are all covered in this textbook for chemists and chemical engineers. This new edition of the standard work 'Nuclear Chemistry' has been completely rewritten and restructured to suit teaching and learning needs in a wide range of chemistry courses, such as basic courses in radiochemistry, or more advanced nuclear chemistry courses. The book is divided into sections that closely fit teaching demands. The first chapter gives a broad introduction and background to the subject, and the second chapter covers stable isotopes. Chapters 3 to 9 comprise what is generally regarded as 'radiochemistry'. Chapters 10 to 17 offer a course in nuclear reaction chemistry. Chapter 18 deals with biological radiation effects for the chemist. The last four chapters give a guide to nuclear energy: energy production, fuel cycle, waste management, the largest applied field of nuclear chemistry. Over 200 exercises, with model answers, remain largely unchanged from the first edition, so teachers working from the earlier text should find only advantages in switching to this new restructured course book on all aspects of nuclear chemistry. The book fully meets the authors objectives, it is well written in a logical, objective, thought-provoking and quite easily readable style. It should appeal to the serious student of radio- and nuclear chemistry at either undergraduate or postgraduate level, as well as to readers with a more general interest in nuclear science and its impact.
on the environment.' - Applied Radiation and Isotopes, July 1995 'This book is an excellent, readable account of a significant part of the scientific achievements of more than half this century. The authors have dedicated the book to Nobel Laureate Glenn T. Seaborg and its scholarship makes it a fitting tribute.' - Radiological Protection Bulletin, December 1995

**Nuclear Chemistry**

Over ten years ago, U.S. nuclear scientists proposed construction of a new rare isotope accelerator in the United States, which would enable experiments to elucidate the important questions in nuclear physics. To help assess this proposal, DOE and NSF asked the NRC to define the science agenda for a next-generation U.S. Facility for Rare Isotope Beams (FRIB). As the study began, DOE announced a substantial reduction in the scope of this facility and put off its initial operation date by several years. The study focused on an evaluation of the science that could be accomplished on a facility reduced in scope. This report provides a discussion of the key science drivers for a FRIB, an assessment of existing domestic and international rare isotope beams, an assessment of the current U.S. position about the FRIB, and a set of findings and conclusions about the scientific and policy context for such a facility.

**Nuclear Forensic Analysis**

The Chemistry of the Actinide and Transactinide Elements is a contemporary and definitive compilation of chemical properties of all of the actinide elements, especially of the technologically important elements uranium and plutonium, as well as the transactinide elements. In addition to the comprehensive treatment of the chemical properties of each element, ion, and compound from atomic number 89 (actinium) through to 109 (meitnerium), this multi-volume work has specialized and definitive chapters on electronic theory, optical and laser fluorescence spectroscopy, X-ray absorption spectroscopy, organoactinide chemistry, thermodynamics, magnetic properties, the metals, coordination chemistry, separations, and trace analysis. Several chapters deal with environmental science, safe handling, and biological interactions of the actinide elements. The Editors invited teams of authors, who are active practitioners and recognized experts in their specialty, to write each chapter and have endeavoured to provide a balanced and insightful treatment of these fascinating elements at the frontier of the periodic table. Because the field has expanded with new spectroscopic techniques and environmental focus, the work encompasses five volumes, each of which groups chapters on related topics. All chapters represent the current state of research in the chemistry of these elements and related fields.

**Radiochemical Analysis: Nuclear Instrumentation, Radiation Techniques, Nuclear Chemistry**

Radiosotope Techniques, July 1966 Through June 1967

**The Transuranium People**

**Nuclear and Radiochemistry**

The field of nuclear and radiochemistry is wide-reaching, with results having functions and use across a variety of disciplines. Drawing on 40 years of experience in teaching and research, this concise book explains the basic principles and applications of the primary areas of nuclear and radiochemistry. Separate chapters cover each main area of recent radiochemistry. This includes nuclear medicine and chemical aspects of nuclear power plants, namely the problems of nuclear wastes and nuclear analysis (both bulk and surface analysis), with the analytical methods based on the interactions of radiation with matter. Furthermore, special attention is paid to thermodynamics of radioisotope tracer methods, the very diluted system (carrier-free radioactive isotopes) and the principles of chemical processes with unsealed radioactive sources. This book will be helpful to students and researchers in chemistry, chemical engineering, environmental sciences, and specialists working in all fields of radiochemistry. Basic concepts are introduced and practical applications explained, providing a full view of the subject. Laboratory work with unsealed radiochemicals is discussed in details that can be applied in research and authority in the lab environment.

**Handbook of Nuclear Chemistry**


**Interfacial Chemistry of Rocks and Soils**

**An Introduction to Radiation Chemistry**

**The Chemistry of the Actinide and Transactinide Elements (3rd ed., Volumes 1-5)**
The leading resource for anyone looking for an accessible and authoritative introduction to nuclear and radiochemistry. In the newly revised Fourth Edition of Nuclear and Radiochemistry: Fundamentals and Applications, distinguished chemist Jens-Volker Kratz delivers a two-volume handbook that has become the gold standard in teaching and learning nuclear and radiochemistry. The book covers the theory and fundamentals of the subject before moving on to the technical side of nuclear chemistry, with coverage of nuclear energy, nuclear reactors, and radionuclides in the life sciences. This latest edition discusses the details and impact of the Chernobyl and Fukushima nuclear disasters, as well as new research facilities, including FAIR and HIM. It also incorporates new insights on target preparation and new processes for nuclear fuel recycling, like EURO-GANEX. Finally, the volumes extensively cover environmental technological advances and the effects of radioactivity on the environment. Readers will also find: - An accessible and thorough introduction to the fundamental concepts of nuclear physics and chemistry, including atomic processes, classical mechanics, relativistic mechanics, and the Heisenberg Uncertainty Principle - Comprehensive explorations of radioactivity in nature, radioelements, radioisotopes and their atomic masses, and other physical properties of nuclei - Practical discussions of the nuclear force, nuclear structure, decay modes, radioactive decay kinetics, and nuclear radiation - In-depth examinations of the statistical considerations relevant to radioactivity measurements Written for practicing nuclear chemists and atomic physicists, Nuclear and Radiochemistry: Fundamentals and Applications is also an indispensable resource for nuclear physicians, power engineers, and professionals working in the nuclear industry.

Modern Nuclear Chemistry

Radiochemistry and Nuclear Chemistry

Impressive in its overall size and scope, this five-volume reference work provides researchers with the tools to push them into the forefront of the latest research. The Handbook covers all of the chemical aspects of nuclear science starting from the physical basics and including such diverse areas as the chemistry of transactinides and exotic atoms as well as radioactive waste management and radiopharmaceutical chemistry relevant to nuclear medicine. The nuclear methods of the investigation of chemical structure also receive ample space and attention. The international team of authors consists of 77 world-renowned experts - nuclear chemists, radiopharmaceutical chemists and physicists - from Austria, Belgium, Germany, Great Britain, Hungary, Holland, Japan, Sweden, Switzerland and the United States. The Handbook is an invaluable reference for nuclear scientists, biologists, chemists, physicists, physicians practicing nuclear medicine, graduate students and teachers - virtually all who are involved in the chemical and radiopharmaceutical aspects of nuclear science. The Handbook also provides for further reading through its rich selection of references.

Isotopes in Nanoparticles

Knowledge of the basic interactions that take place between geological materials and different substances is the first step in understanding the effects of adsorption and other interfacial processes on the quality of rocks and soils, and on driving these processes towards a beneficial or neutral result. Interfacial Chemistry of Rocks and Soils examines the different processes at solid and liquid interfaces of soil and rock, presenting a complete analysis that emphasizes the importance of chemical species on these interactions. Summarizing the results and knowledge of the authors’ research in this field over several decades, this volume: Explores the individual components of the studied systems: the solid, the solution, and the interface Discusses the characteristics and thermodynamics of the interface Illustrates the kinetic aspects of interfacial reactions Examines interfacial processes in a montmorillonite model system Demonstrates transformations initiated by interfacial processes Studies interfacial processes of real rock and soil solution systems Outlines avenues of treatment that may solve geological, soil science, and environmental problems Profiles the most important analytical methods in the study of interfacial processes Previous books in this area typically focus on selected aspects of the subject, such as the properties of the solid phase, or the interactions of selected substances with soil/rock. This book comprehensively treats the soil-liquid-interface system. Drawn chiefly from the authors’ years of research at the Isotope Laboratory in the Department of Colloid and Environmental Chemistry at the University of Debrecen in Hungary, this book discusses chemical reactions on the surfaces/interfaces of soils and rocks; examines the role of these processes in environmental, colloid and geochemistry; and explores the effects on agricultural, environmental and industrial applications.

Nuclear Chemistry

Modern Nuclear Chemistry

The first book for advanced students of chemistry and chemical engineering to cover both basic nuclear chemistry and the whole nuclear power fuel cycle including waste handling and storage and associated hazards. Covers all major advances in the field up to 1978. Includes problems and solutions. The book has been course tested at Chalmers University of Technology, Sweden

Nuclear Chemistry

This revised and extended 6 volume handbook set is the most comprehensive and voluminous reference work of its kind in the field of nuclear chemistry. The Handbook set covers all of the chemical aspects of nuclear science starting from the physical basics and including such diverse areas as the chemistry of transactinides and exotic atoms as well as radioactive waste management and radiopharmaceutical chemistry relevant to nuclear medicine. The nuclear methods of the investigation of chemical structure also receive ample space and attention. The international team of authors consists of scores of world-renowned experts - nuclear chemists, radiopharmaceutical chemists and physicists - from Europe, USA, and Asia. The Handbook set is an invaluable reference for nuclear scientists, biologists, chemists, physicists, physicians practicing nuclear medicine, graduate students and teachers - virtually all who are involved in the chemical and radiopharmaceutical aspects of nuclear science. The Handbook set also provides further reading via the rich selection of references.
Principles of Radiochemistry

The IAEA has compiled this overview of current applications of nuclear analytical techniques (NATs). The contributions included in this book describe a variety of nuclear techniques and applications, such as those in the fields of environment and health, industrial processes, non-destructive testing, forensic and archaeological investigations, cosmochemistry and method validation. The techniques covered range from classical instrumental neutron activation analysis (INAA), its radiochemical derivative RNAA, in-beam methods such as prompt γ neutron activation analysis (PGNAA) and accelerator mass spectrometry (AMS), to X ray fluorescence (XRF) and proton induced X ray emission (PIXE) spectroscopy. Isotopic techniques to investigate element behaviour in biology and medicine, and also to validate other non-nuclear analytical techniques, are described. Destructive and non-destructive approaches are presented, along with their use to investigate very small and very large samples, archaeological samples and extraterrestrial samples. Several nuclear analytical applications in industry are described that have considerable socioeconomic impact wherever they can be implemented.

The Transuranium Elements

Atomic and Nuclear Chemistry

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