Nitroxides
Synthesis, Properties and Applications

Olivier Ouari Aix-Marseille University, France
Didier Gigmes Aix-Marseille University, France

Synopsis
Nitroxides are versatile small organic molecules possessing a stabilised free radical. With their unpaired electron spin, they display a unique reactivity towards various environmental factors, enabling a diverse range of applications. This book covers the synthesis, physicochemical studies and applications of nitroxides, showcasing the developments that have occurred in recent years. Edited and written by experts working in the field, this title will be of interest to graduate students and researchers working across chemistry, physics, biology and materials science.

Brief Contents
- A Brief History and Outlook of Nitroxides
- General Approaches to Synthesis of Nitroxides
- The Application of Nitroxides in Organic Synthesis
- Spin Probes and Imaging Using Nitroxides
- Nitroxides in Battery-related Applications
- Computational Tools for Nitroxide Design
- Nitroxide-mediated Polymerization
- Nitroxides in Supramolecular Chemistry
- Magnetism of Nitroxides
- Applications of Nitroxide Spin Labels to Structural Biology
- Nitroxides in Liquid Crystals
- Nitroxide Intervention in Oxidative and Free Radical Damage in Biology and Disease
- Spin Trapping
- Biological Applications of Nitroxide Stable Free Radicals
- Introduction to Electron Paramagnetic Resonance (EPR) of Nitroxides
Chemical Modelling
Volume 16

Michael Springborg University of Saarland, Germany
Jan-Ole Joswig Dresden University of Technology, Germany

Synopsis
Chemical modelling covers a wide range of disciplines and this book is the first stop for any materials scientist, biochemist, chemist or molecular physicist wishing to acquaint themselves with major developments in the applications and theory of chemical modelling. Containing both comprehensive and critical reviews, this volume is a convenient reference to the current literature.

Brief Contents
- Accelerated discovery of new molecules for excitonic solar cells via machine learning and virtual screening
- Computational modelling of isomeric polyoxometalates
- Molecular modeling of cyclodextrin inclusion complexes
- Heterojunctions of armchair graphene nanoribbons
- Proton transport and the topology of hydrogen bond networks: The case of phosphoric acid and water systems
- From global to local – hybrid density functionals for weak and strong correlation
Reducing Agents in Colloidal Nanoparticle Synthesis

Stefanos Mourdikoudis University College London, UK

Synopsis

Nanoparticles can be synthesised via a number of methods, including laser ablation, thermal decomposition, chemical reduction and polyol synthesis. This book highlights the role of reducing agents in the chemical synthesis of nanoparticle systems, presenting the main categories of reducing agents, which vary in reactivity, selectivity, availability and toxicity. With contributions from global experts, this title is appropriate for graduate students and researchers in nanochemistry, colloidal synthesis, inorganic chemistry, organometallic chemistry, chemical engineering, physical chemistry, materials science, biology and physics.

Brief Contents

- Reducing Agents in Colloidal Nanoparticle Synthesis - an Introduction
- Role of Alcohols in Colloidal Nanoparticle Synthesis
- Polyols as a Toolbox for the Preparation of Inorganic-based Nanostructures
- Role of Phenols and Phenol Derivatives in the Synthesis of Nanoparticles
- Gases
- Amines and Amine-boranes
- Acids
- Amino Acids and Peptides in Colloidal Nanoparticle Synthesis
- Hydrides
- Polysaccharides
- Other Polymers
- Biological Materials
- Proteins Engineer the Size and Morphology of Noble Metal Nanoparticles
- Silicon Nanoparticles and Carbon Dots
- Miscellaneous Reductants
Georgios Tsaparlis
University of Ioannina, Greece

Synopsis

Problem solving is central to the teaching and learning of chemistry at secondary, tertiary and post-tertiary levels of education, opening to students and professional chemists alike a whole new world for analysing data, looking for patterns and making deductions. Within this book many situations are considered, some general and some with a focus on specific areas of chemistry. The book concludes with methodological and epistemological issues in problem solving research and new perspectives in problem solving in chemistry.

Brief Contents

- Introduction – The Many Types and Kinds of Chemistry Problems
- Qualitative Reasoning in Problem-solving in Chemistry
- Scaffolding Metacognition and Resource Activation During Problem Solving
- Deconstructing the Problem-solving Process
- An Overview of the Working Memory Overload Hypothesis
- Mechanistic Reasoning Using the Electron-pushing Formalism
- Scaffolding Synthesis Skills in Organic Chemistry
- Problem Solving Using NMR and IR Spectroscopy
- Assessing System Ontology in Biochemistry: Analysis of Students’ Problem Solving in Enzyme Kinetics
- Problem Solving in the Chemistry Teaching Laboratory
- Problems and Problem Solving in the Light of Context-based Chemistry
- Using Team-Based Learning to Promote Problem Solving Through Active Learning
- Technology, Molecular Representations, and Student Understanding in Chemistry
- An Educational Software for Supporting Students’ Learning of IR Spectral Interpretation
- Exploring Chemistry Problems with Computational Quantum Chemistry Tools in the Undergraduate Chemistry Curriculum
- Methodological and Epistemological Issues in Science Education Problem-solving Research: Linear and Nonlinear Paradigms
- Issues, Problems and Solutions: Summing It All Up
- Postscript – Two Issues for Provocative Thought
Advance Book Information

Disposable Electrochemical Sensors for Healthcare Monitoring
Material Properties and Design

A Pandikumar CSIR-Central Electrochemical Research Institute, India
K S Shalini Devi CSIR-Central Electrochemical Research Institute, India

Synopsis

This book focuses on the variety of emerging multi-functional materials and biomarkers involved in monitoring major disorders and diseases using disposable electrodes. The specificity of these sensors improves with incorporation of nanocomposites, hybrids or coating with conductive materials. These electrochemical sensors designed with disposable electrodes are modified with various biomarkers, aptamers or specific antibodies for the detection of targeted diseases or disorders. Aimed at academic and research institutes at both the graduate and postgraduate level, the book will be of interest to the healthcare industries.

Brief Contents

- Design and Fabrication of Disposable Sensors: An Overview
- Carbon Nanotubes Chemically-modified Screen-printed Electrodes
- Electrochemical Platforms for Biomedical Applications
- Mesoporous Carbon-based Disposable Sensors
- Graphene-based Disposable Sensors
- Graphitic Material-based Disposable Sensors
- Metal Nanoparticles-based Disposable Sensors
- Metal Oxide-based Disposable Sensors for Health Monitoring
- Metal-Organic Framework-based Disposable Sensors
- Metal Chalcogenides-based Disposable Sensors
- Conducting Polymer-based Disposable Sensors
- Quantum Dots-based Disposable Sensors
- Mxene-based Disposable Sensors
- Functionalized Macromolecules-based Disposable Sensors
- Existing Point-of-care Diagnostics: Merits and Demerits
- Future Perspectives of Disposable Electrochemical Sensors

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The Chemical Biology of Nitrogen

Christopher T Walsh Stanford University, USA

Synopsis
From DNA and RNA to proteins and vitamins the role of nitrogen is central in organismal metabolism. The Chemical Biology of Nitrogen comprehensively examines how the chemistry available to both inorganic and organic nitrogen compounds both enable and conditions the vast array of nitrogen biologies. This book provides a chemocentric approach to both the inorganic and organic chemical biology of nitrogen. Following an introduction to nitrogen trivalency the book progresses through the logic of inorganic nitrogen metabolism and organic nitrogen metabolites to nitrogen proteomics with an integrative approach to understanding the role of nitrogen in its many biologic roles. Authored by a renowned scientist and educator, this book is ideal for researchers in chemical biology and nitrogen metabolism and will be of particular interest to advanced students and postgraduates in biochemistry and chemical biology.

Brief Contents
- Introduction to Nitrogen Chemical Biology
- Inorganic Nitrogen Biochemistry and Dinitrogen Reduction to Ammonia by Nitrogenase
- Ammonia Oxidation: Nitrification vs. Anammox
- Nitrate Ion Reductive Metabolism: Bifurcation Between Five-electron or Eight-electron Reductions
- Chemical Strategies Underlying the Biological Flux of Inorganic Nitrogen Species
- Amination Reactions: Incorporation of Ammonia Into Amino Acid Frameworks
- When Ammonia Becomes Toxic: Ureido and Guanidinium Forms of Organic Nitrogen
- Metabolic Capture of Amines, Imines and Enamines
- Nitrogen Heterocycles
- B Vitamin Nitrogen Heterocycles
- Tetrapyrrole Macrocycles: Aminopyrroles and the Pigments of Life
- Organic Nitrogen Oxygenations
- Nitriles, Cyanohydrins and Cyanogenesis
- One-electron Nitrogen Chemical Biology
- Peptide Bond Formation Strategies in Nonribosomal and Ribosomal Assembly Lines
- Nitrogen Side Chains in Enzyme Catalysis and Posttranslational Modifications
Advance Book Information

All-carbon Composites and Hybrids

Oxana V. Kharissova Universidad Autónoma de Nuevo León, Mexico
Boris Kharisov Universidad Autónoma de Nuevo León, Mexico

Synopsis

All-carbon composites are carbon materials reinforced with other carbon materials, typically nanostructures such as carbon fibres. There are a large number of all-carbon materials, many of which demonstrate unique and useful sets of properties. Combining and hybridising different carbon materials and nanomaterials together also opens up a number of possibilities to fine-tune the materials for desirable combinations of these properties. This book provides a broad overview of these materials and their uses.

Brief Contents

- Hybrids of Graphite, Graphene and Graphene Oxide
- Production of Carbon Nanostructure/Graphene Oxide Composites by Self-assembly and their Applications
- Synthesis of Carbon Nanotube/Graphene Hybrids by Chemical Vapor Deposition
- Design of Graphene/CNT-based Nanocomposites: A Stepping Stone for Energy-related Applications
- One-dimensional Carbon Nanotube Decorated Two-dimensional Reduced Graphene Oxide Composite: Insight from Synthesis to Application in Dye Sensitized Solar Cells
- Carbon Dot-based Composites: Recent Progress, Challenges and Future Outlook
- Carbon Dots Derived from Natural Carbon Sources: Preparation, Chemical Functionalization, Characterization, and Applications
- Composites of Carbon Nanodots for Hydrogen Energy Generation
- Clusters of Fullerenes
- Less-common Carbon–Carbon Nanocomposites
- Advances in Polymeric Nanocomposites Incorporating Graphene–Fullerene and Graphene Oxide–Fullerene Hybrids
- Mechanical Properties of Graphene–Carbon Nanotube Reinforced Hybrid Polymer Nanocomposites
- Final Remarks

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Microalgal Biotechnology
Recent Advances, Market Potential, and Sustainability

Ajam Shekh University of Queensland, Australia
Peer Schenk University of Queensland, Australia
R Sarada Central Food Technological Research Institute, India

Synopsis
Microalgal Biotechnology consolidates the latest research in the field together with a look at market potential and policy considerations. Highlighting the huge potential of microalgae as commercial commodities, it covers progress on various fronts including; bio-refinery, genetic engineering, CO2 utilisation, biosafety and regulatory issues, open and closed photo-bioreactors for high value metabolites production, market space and sustainability for algal products.

Brief Contents
- Microalgae as Cell Factories: Food and Feed-grade High-value Metabolites
- Microalgal Biorefineries: Key Processes and Main Challenges
- Recent Advancements in Algal Biorefineries
- Technological Bottlenecks in Establishing of Microalgal Biorefineries
- Production of High-value Metabolites from Microalgae
- Microalgae as an Alternative Sustainable Source of Squalene
- Network of Metabolic Pathways for Biosynthesis of High-value Products in Microalgae
- Genetic Engineering of Microalgae for the Production of High-value Metabolites: Status and Prospects
- Recent Advances in Closed Photobioreactors and Open Cultivation of Microalgae
- Challenges in Scale-up and Commercialization of Microalgae Products
- Biosafety and Regulatory Issues Related to Genetically Modified Microalgae
- Application of Microalgae for Food Supplements and Animal Feed: Scientific, Sustainability and Socioeconomic Challenges
- Life Cycle Assessment Perspective of Microalgae Cultivation for High-value Nutraceuticals
- Environmental Impact Assessment and Sustainability of Microalgae Production
- Market Penetration, Potential and Sustainability of Algal Products

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Graphene-based 3D Macrostructures for Clean Energy and Environmental Applications

Rajasekhar Balasubramanian National University of Singapore, Singapore
Shamik Chowdhury Indian Institute of Technology, India

Synopsis
This book provides a critical and comprehensive account of the recent advances in the development and potential applications of high performance 3D GBMs for tackling global energy and environmental issues in a sustainable manner.

Brief Contents
- Engineering the Architecture of 3D Graphene-based Macrostructures
- Structure-Property Relationships in 3D Graphene-based Macrostructures
- Flexible 3D Graphene-based Electrodes for Lithium Ion Batteries
- 3D Graphene-based Materials for Enhancing the Energy Density of Sodium Ion Batteries
- Ultrafast Charging Supercapacitors Based on 3D Macrostructures of Graphene and Graphene Oxide
- 3D GBM-supported Transition Metal Oxide Nanocatalysts and Heteroatom-doped 3D Graphene Electrocatalysts for Potential Application in Fuel Cells
- 3D Graphene-based Scaffolds with High Conductivity and Biocompatibility for Applications in Microbial Fuel Cells
- Fuelling the Hydrogen Economy with 3D Graphene-based Macroscopic Assemblies
- Harvesting Solar Energy by 3D Graphene-based Macroarchitectures
- 3D Graphene-based Macrostructures as Superabsorbents for Oils and Organic Solvents
- Fast and Efficient Removal of Existing and Emerging Environmental Contaminants by 3D Graphene-based Adsorbents
- Freestanding Photocatalytic Materials Based on 3D Graphene for Degradation of Organic Pollutants
- 3D Graphene-based Macroassemblies for On-site Detection of Environmental Contaminants
- Graphene-based Macroassemblies as Highly Efficient and Selective Adsorbents for Postcombustion CO\textsubscript{2} Capture
- Artificial Photosynthesis by 3D Graphene-based Composite Photocatalysts

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Challenges in Detection Approaches for Forensic Science

Lynn Dennany University of Strathclyde, UK

Synopsis

This book explores the specific challenges encountered by forensic scientists and the developments that are being made to address the requirement of law enforcement agencies within the framework of the legislative requirements. Currently there are many forensic science books that focus on the underlying theory of chemical approaches, but this book fills the gap in the dissemination of the current state of the art approaches for forensic science. This includes current detection strategies and how legislation and changes to forensic practices has prompted these changes as well as how research in the field is seeking to address the current hurdles in a cohesive manner. For graduates and forensic professionals, it also covers essential principles for students and illustrate how these relate to applications.

Brief Contents

- Detection Strategies for Traditional Illicit Substances
- Novel Detection Approaches to Tackle the Challenges of Complex Matrices for Alternative Drugs and New Psychoactive Substances
- Challenges in the Analysis of Toxicological Samples
- Fingermarks
- New Challenges in Forensic DNA Analysis
- Challenges in Fire Investigation
- Interpretative Challenges for Forensic Chemistry
- Hybrid Likelihood Ratio Models for Forensic Applications: a Novel Solution to Determine the Evidential Value of Physicochemical Data
Synopsis

Very high levels of pollution are regularly observed in cities across the world. Predicting urban air quality demands detailed knowledge of both the physical properties of the urban atmosphere and pollutants within it, and the chemical reactions, which can transform one pollutant into another. This Faraday Discussion looks at the underlying processes responsible; an essential pre-requisite to developing the high quality numerical models of urban air pollutants, which are required to develop and test mitigation strategies prior to implementation.

Brief Contents

- Current status and trends in air quality in megacities
- Physico-chemical processes in the urban atmosphere (neighbourhood scale)
- Physico-chemical processes in the urban atmosphere (city scale)
- Effects, mitigation and policy
Advance Book Information

Chemistry of 2-Dimensional Materials: Beyond Graphene
Faraday Discussion 227

Synopsis
Graphene has extraordinary chemical and physical properties ensuring its use in opto-electronics, energy and biomedical applications. One of the greatest challenges is to develop and master chemical strategies for other 2D materials such as transition metal dichalcogenides. This Faraday Discussion covers all areas related to other 2D materials’ chemistry spanning from their theoretical/computational prediction to their synthesis and functionalization yielding 2D and 3D systems with tailor made physical properties for a wide range of applications.

Brief Contents
- 2D materials production and generation of functional inks
- Biomedical applications
- Applications in energy
- Applications in opto-electronics

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Molecular Biology and Biotechnology

Ralph Rapley University of Hertfordshire, UK

Synopsis
This popular textbook has been revised and updated to provide a comprehensive overview and to reflect the latest developments in this rapidly developing area. Advances in basic research at the molecular level have provided many insights into biological processes and allowed the production of new developments across the fields of genome editing, proteomics, agriculture, microbial biotechnology, bioinformatics and therapeutics. This new edition provides the reader with a number of key areas in discrete chapters either updated from the previous edition or written as entirely new chapters concerning emerging fields. By presenting information in an easily assimilated form, this book makes an ideal undergraduate text for students of biology and chemistry, as well as appealing to postgraduates.

Brief Contents
- Basic Molecular Biology Techniques
- Genes and Genomes
- Protein Expression and Production
- Proteins and Proteomics
- Transgenesis
- The Biotechnology and Molecular Biology of Yeast
- Antibody Engineering and Immunotherapeutics
- Human and Animal Cell Culture
- Genome Editing
- Genome Sequencing
- Introduction to Bioinformatics
- Nanotechnology in Medicine
- Biosensors
- Modelling and Simulation of Proteins
- Agricultural Biotechnology
- Vaccine Design Strategies: Pathogens to Genomes
- Intellectual Property and Biotechnology Patents