

Selenium and Tellurium Chemistry

J. Derek Woollins • Risto S. Laitinen
Editors

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From Small Molecules to Biomolecules
and Materials

 Springer

Editors

J. Derek Woollins
University of St Andrews, UK
School of Chemistry
North Haugh
KY16 9ST St. Andrews
United Kingdom
jdw3@st-andrews.ac.uk

Risto S. Laitinen
University of Oulu
Dept. of Chemistry
PO Box 3000
90014 Oulu
Finland
risto.laitinen@oulu.fi

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Preface

Both selenium and tellurium are very rare. Selenium has an abundance at 0.05–0.09 parts per million and is among the 25 least common elements in the Earth's crust. Tellurium is even rarer with an abundance of about one part per billion being rarer than gold, silver, or platinum and ranks about 75th in abundance of the elements in the earth. Selenium is used in glass-making and in electronics. One of the most common uses is in plain-paper photocopiers and laser printers. Selenium is also used to make photovoltaic ("solar") cells. Most of the tellurium produced today is used in alloys such as tellurium-steel alloy (approx. 0.04% tellurium), which has better machinability than steel without tellurium. Tellurium has potential for a variety of electrical devices such as CdHgTe IR detectors and it can be used to improve picture quality in photocopiers and printers.

Recent decades have witnessed significant progress in the chemistry of selenium and tellurium. New compounds with novel bonding arrangements, unprecedented structures, and unusual reactivities have been reported comprising in many cases systems which have been regarded as impossible. Such development extends the theories on molecular structures and bonding.

The driving force in the research of inorganic and organic chemistry of selenium and tellurium chemistry also arises from demands of materials science and from advances in biochemistry and medicine. There is an ever-growing need to gain firm understanding of the relationship of molecular and electronic structures with the properties and functionalities observed in the bulk phase. As a result of these investigations, both new and old materials are finding virtually unlimited number of applications. Semiconductors, insulators, coatings, ceramics, catalysts, nanotubes, polymers, and thin films all play a significant role in the current main group chemistry research as well as in the modern technological society. In this context, the increasing need for replacements for fossil fuels has driven forward the development of alternative energy sources in which selenium and tellurium compounds such as cadmium telluride are poised to play an important role. Many selenium and tellurium compounds have also found utility as reagents in synthetic organic and inorganic chemistry. Many selenium species can act as mild oxidants

and conversely, organotellurium compounds have an ability to reduce different functional groups and cleave carbon-heteroatom bonds. Organotellurium ligands have also attracted interest in coordination chemistry, with the goal of designing suitable single source precursors for chemical vapor deposition processes.

The biological significance of selenium was recognised in 1973 when it was found to be an integral part of the enzyme glutathione peroxidase and is a very potent antioxidant protecting the body from damage due to oxidation by free radicals. The role of selenium compounds as antitumor agents is also under active investigation.

This volume illustrates some of the exciting developments in chemistry, materials and biochemistry of selenium and tellurium. The contributions are based on (but not limited to) the invited lectures in 11th International Conference on the Chemistry of Selenium and Tellurium (ICCST-11) held in Oulu, Finland on August 1–6, 2010. We are grateful to the contributing authors for their prompt delivery of the articles, which has made completing the volume in a timely fashion a pleasant experience.

March 2011

J. Derek Woollins
Risto S. Laitinen

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List of Contributors

Eduardo E. Alberto Chemistry Department, Federal University of Santa Maria, Santa Maria, RS, Brazil

Jens Beckmann Fachbereich 2: Biologie/Chemie, Institut für Anorganische und Physikalische Chemie, Universität Bremen, Bremen, Germany

Antonio L. Braga Chemistry Department, Federal University of Santa Catarina, Florianópolis, SC, Brazil

Tristram Chivers Department of Chemistry, University of Calgary, Calgary, AB, Canada

Jason L. Dutton Department of Chemistry, The University of Western Ontario, London, ON, Canada

Pamela Finke Fachbereich 2: Biologie/Chemie, Institut für Anorganische und Physikalische Chemie, Universität Bremen, Bremen, Germany

Leopold Flohé Department of Chemistry, Otto-von-Guericke-Universität Magdeburg, Magdeburg, Germany

Diana M. Freudendahl School of Chemistry, Cardiff University, Cardiff, UK

Richard S. Glass Department of Chemistry and Biochemistry, The University of Arizona, Tucson, AZ, USA

S. Hesse Laboratoire d'Ingénierie Moléculaire et Biochimie Pharmacologique, Institut Jean Barriol, Université Paul Verlaine Metz, Metz, France

Guoxiong Hua School of Chemistry, University of St Andrews, St Andrews, UK

G. Kirsch Laboratoire d'Ingénierie Moléculaire et Biochimie Pharmacologique, Institut Jean Barriol, Université Paul Verlaine Metz, Metz, France

Jari Konu Department of Chemistry, University of Calgary, Calgary, AB, Canada

Risto S. Laitinen Department of Chemistry, University of Oulu, Oulu, Finland

Chen-Wei Liu Department of Chemistry, National Dong Hwa University, Taiwan, China

Mohammad Azad Malik School of Chemistry, The University of Manchester, Oxford Road, Manchester, UK

Rüdiger Mews Institute for Inorganic and Physical Chemistry, University of Bremen, Bremen, Germany

Paul O'Brien School of Chemistry, The University of Manchester, Manchester, UK

Raija Oilunkaniemi Department of Chemistry, University of Oulu, Oulu, Finland

E. Perspicace Laboratoire d'Ingénierie Moléculaire et Biochimie Pharmacologique, Institut Jean Barriol, Université Paul Verlaine Metz, Metz, France

Paul J. Ragnogna Department of Chemistry, The University of Western Ontario, London, ON, Canada

Karthik Ramasamy School of Chemistry, The University of Manchester, Manchester, UK

Thomas Wirth School of Chemistry, Cardiff University, Cardiff, UK

J. Derek Woollins School of Chemistry, University of St Andrews, St Andrews, UK

Andrey V. Zibarev Institute of Organic Chemistry, Russian Academy of Sciences, Novosibirsk, Russia; Department of Physics, National Research University – Novosibirsk State University, Novosibirsk, Russia