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Elemental Sulfur and Sulfur-Rich Compounds I

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Preface

Despite more than 200 years of sulfur research the chemistry of elemental sulfur and sulfur-rich compounds is still full of "white spots" which have to be filled in with solid knowledge and reliable data. This situation is particularly regrettable since elemental sulfur is one of the most important raw materials of the chemical industry produced in record-breaking quantities of ca. 35 million tons annually worldwide and mainly used for the production of sulfuric acid.

Fortunately, enormous progress has been made during the last 30 years in the understanding of the "yellow element". As the result of extensive international research activities sulfur has now become the element with the largest number of allotropes, the element with the largest number of binary oxides, and also the element with the largest number of binary nitrides. Sulfur, a typical non-metal, has been found to become a metal at high pressure and is even superconducting at 10 K under a pressure of 93 GPa and at 17 K at 260 GPa, respectively. This is the highest critical temperature of all chemical elements. Actually, the pressure-temperature phase diagram of sulfur is one of the most complicated of all elements and still needs further investigation.

Sulfur compounds have long been recognized as important for all life since sulfur atoms are components of many important biologically active molecules including amino acids, proteins, hormones and enzymes. All these compounds take part in the global geobiochemical cycle of sulfur and in this way influence even the earth's climate. In interstellar space, on other planets as well as on some of their moons have elemental sulfur and/or sulfur compounds also been detected. The best known example in this context is probably Iupiter's moon Io, first observed by Galileo Galilei in 1610, which according to modern spectroscopic observations made from the ground as well as from spacecrafts is one of the most active bodys in the solar system with quite a number of sulfur volcanoes powered by sulfur dioxide and spraying liquid sulfur onto the very cold surface of this moon.

The general importance of sulfur chemistry is reflected in the long list of monographs on special topics published continuously, as well as in the huge number of original papers on sulfur related topics which appear every year. Regularly are international conferences on organic and inorganic sulfur chemistry held, and specialized journals cover the progress in these areas.

In Volumes 230 and 231 of *Topics in Current Chemistry* eleven experts in the field report on the recent progress in the chemistry and physics of elemental

sulfur in the solid, liquid, gaseous and colloidal form, on oxidation products of elemental sulfur such as polyatomic sulfur cations and sulfur-rich oxides which both exhibit very unusual structures, on classical reduction products such as polysulfide dianions and radical anions as well as on their interesting coordination chemistry. Furthermore, the long homologous series of the polysulfanes and their industrial significance are covered, and novel methods for the removal of poisonous sulfur compounds from wastegases and wastewaters in bioreactors taking advantage of the enzymatic activities of sulfur bacteria are reviewed. In addition, the modern ideas on the bonding in compounds containing sulfur-sulfur bonds are outlined.

The literature is covered up to the beginning of the year 2003. A list of useful previous reviews and monographs related to the chemistry of sulfur-rich compounds including elemental sulfur is available on-line as suplementary material to these Volumes.

As the guest-editor of Volumes 230 and 231, I have worked for 40 years in basic research on sulfur chemistry, and I am grateful to my coworkers whose names appear in the references, for their skillful experimental and theoretical work. But my current contributions to these Volumes would not have been possible without the continuous encouragement and assistance of my wife Yana who also took care of some of the graphical work. The constructive cooperation of all the co-authors and of Springer-Verlag, Heidelberg, is gratefully acknowledged.

Berlin, April 2003 Ralf Steudel

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