

Preface

Vanadium, named after the Nordic Goddess Vanadis, is a biologically essential element. Vanadium complexes, including organovanadium compounds, are present in a variety of configurations depending on their oxidation state and coordination number. Vanadium can exist in oxidation states ranging from -3 to $+5$, and generally converts between states via one-electron redox processes.

The inclusion of vanadium species in enzymes such as haloperoxidase and nitrogenase reveals the importance of its redox chemistry. Some tunicates, marine sea squirts, selectively accumulate vanadium ions from the ocean. Vanadate is an inhibitor of ATPases to permit the investigation on insulin mimic properties.

Vanadium compounds in high oxidation states can induce oxidative transformations including enzymatic reactions. A variety of oxidative transformations are achieved, as exemplified by dehydrogenation, oxidative coupling, and oxidation of carbonyl compounds and main-group organometallics. The oxo functionality of oxovanadium compounds participates in a number of unique oxo-transfer reactions. Haloperoxidases contain this functionality and have been mimicked. Vanadium peroxides can cause either oxygenation or epoxidation. The vanadium-catalyzed epoxidation of allylic alcohols with alkyl hydroperoxide provides a useful synthetic route to chiral epoxy alcohols.

On the contrary, low-valent vanadium compounds are known to induce one-electron reduction reactions. This redox process permits the development of a wide range of organic reactions like dehalogenation, deoxygenation and hydrogenation, reductive coupling, and

nitrogen fixation, depending on the redox potential of the vanadium compounds.

These redox properties of vanadium compounds are unique in biological chemistry and chemistry. Furthermore, a variety of applications have been investigated to provide Ziegler–Natta polymerization catalysts, paramagnetic materials, batteries, and so on from the viewpoint of materials science.

The Third International Symposium on Chemistry and Biological Chemistry of Vanadium was held on the Suita campus of Osaka University from 26th to 29th of November, 2001. This symposium follows the first one in Cancun, Mexico (The 5th Chemical Congress of North America, D.C. Crans and A.S. Tracey) in November, 1997, and the second one in Berlin, Germany (The 37th IUPAC Congress/27th GDCh General Meeting, D. Rehder and V. Conte) in August, 1999. The scientific program addresses the biological chemistry and chemistry of vanadium including inorganic chemistry, chemistry of catalysis, materials chemistry, and organic synthesis. The review articles of this issue cover most of the aspects of vanadium science and biological chemistry mentioned above.

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