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Element 74, the Wolfram Versus Tungsten Controversy

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Abstract

Two and a quarter centuries ago, a heavy mineral ore was found which was thought to contain a new chemical element called heavy stone (or tung-sten in Swedish). A few years later, the metal was separated from its oxide and the new element ($Z=74$) was called wolfram. Over the years since that time, both the names wolfram and tungsten were attached to this element in various countries. Sixty years ago, IUPAC chose wolfram as the official name for the element. A few years later, under pressure from the press in the USA, the alternative name tungsten was also allowed by IUPAC. Now the original, official name “wolfram” has been deleted by IUPAC as one of the two alternate names for the element. The history of this controversy is described here.

Introduction

Pilar Goya and Pascual Roman had expressed a concern¹ about the revision of the Red Book² (Nomenclature of Inorganic Chemistry - IUPAC Recommendations 2005), in which wolfram was deleted as an alternative name for tungsten (element 74). They argued that the case of wolfram, which was recommended by IUPAC with the alternative name of tungsten allowed in the English speaking world, was significantly different from that of other elements where the listed second name referred to the Latin root of that element and which explained the chemical symbol associated with that element.

Luis Oro and Javier Garcia brought up this issue of the deletion of the name wolfram again at the meeting of the Inorganic Chemistry Division Committee during the 44th IUPAC General Assembly in Torino, Italy in August 2007, where Oro and Garcia are Division Committee Titular Members. Following a few initial brief comments on this issue, it was decided to postpone a detailed discussion of this matter until the upcoming “off-year” meeting of the Division II Committee in Helsinki, Finland, which is scheduled for August 2008. This paper addresses some of the basic issues that were involved in the previous history of these disputed names for element 74. Since most of these discussions were held fifty to sixty years ago, many (if not most) of the participants in this present discussion may be completely unaware of the existence of, or any of the details of the earlier decision about the naming controversy and the origin of the use of the two names by IUPAC.

Early History

The early history of element 74 is well established. During the sixteenth century, the mineral wolframite [(Fe, Mn) WO₄] was noted in the literature. The origin of the name wolframite comes from the fact that the mineral interfered with the reduction of the principal ore of tin, cassiterite, (SnO₂). The mineral was said to devour the tin like a wolf devours a sheep.

Some two centuries later, the Swedish chemist and mineralogist, Axel Fredrik Cronstedt discovered a heavy mineral that he called heavy stone (or “tung-sten” in Swedish). He thought that this mineral contained a new element. Carl Wilhelm Scheele, who worked as a pharmacist and private tutor in Uppsala, isolated the tri-oxide of the element in 1781. He did not isolate the pure element. This tungsten mineral was later called scheelite, CaWO₄.

Torbern Bergman at Uppsala predicted that the acid isolated by Scheele contained a new metal. He thought that it should be possible to prepare the metal by charcoal reduction. During 1782, a Spanish nobleman named Juan Jose de Elhuyar, studied under Bergman at the University of Uppsala. Returning to Spain in 1783, Juan Jose and his brother Fausto de Elhuyar were the first to prepare this metal by reduction with carbon, as suggested by Bergman. They named this element wolfram. The name wolfram was established in Germany and Scandinavia, while the Anglo-Saxon countries preferred Cronstedt's name of tungsten.

The IUPAC Connection

The original International Commission on Atomic Weights preceded the formation of the International Association of Chemical Societies (IACS), in 1911, by more than a decade and the formation of the International Union of Pure and Applied Chemistry (IUPAC), in 1919, by about two decades. The Atomic Weights Commission, which had been part of the IACS, joined IUPAC at its inception. At the first Conference, there did not exist a Commission on Nomenclature within IUPAC, but one was created at the next IUPAC Conference.

The Atomic Weights Commission was reorganized in 1923 within a Commission on the Chemical Elements of IUPAC. In 1930, this Chemical Elements Commission was divided into a number of separate Commissions including one on the Atomic Weights and a Commission on Atoms that was formed to cover the areas of isotopes, atomic structure, physical methods for masses and nuclear chemistry.

The desirability of fixing element names, which could be used with little adaptation in different languages and of facilitating the adoption of universal element symbols in a chemical formula was of concern to IUPAC. During the first half of the Twentieth Century, there was a particular issue regarding the long-standing controversy over the

two chemical names, beryllium and glucinium (with chemical symbols Be and Gl), for element number 4, which were currently used in different groups of countries.

There was no IUPAC Conference (General Assembly) between the years 1938 (the 13th Conference) and 1947 (the 14th Conference) because of World War II. During the 1947 IUPAC Conference in London, the problem of approving a name for a number of new chemical elements that had been discovered in the previous decade, as well as resolving the controversy of the disputed names for other elements was initially referred to the Atoms Commission. Unfortunately, the Atoms Commission was involved in the process of dissolving itself during this 14th IUPAC Conference³. As a result, the matter of these element names was referred to two other IUPAC Commissions, the Commission on Nomenclature of Inorganic Chemistry (CNIC) and the Atomic Weights Commission. A joint meeting of these Commissions was planned to take place during the 15th IUPAC Conference in Amsterdam, the Netherlands in 1949.

The IUPAC Authority for the Names of the Chemical Elements

At that particular period in time (1947-1949), the situation facing the Commission on Atomic Weights was the following. Most of the Commission members had either died or had withdrawn after the 1947 meeting because of their professional retirement. During early 1949, Edward Wichers (US National Bureau of Standards) was asked by the Union's Executive Committee to serve as chairman and to reorganize the Commission. To acquaint himself with the Commission's past procedures, Wichers wrote to Professor Gregory Baxter (Harvard University), who had been the previous Commission President from 1930 to 1947. In the correspondence, Wichers mentioned the problem of the element names. He noted that the 1947 atomic weight table in French listed "Tu" as a second choice symbol for tungsten.

Baxter replied to Wichers that his procedure in the past was to write and then circulate each report (in English) on the Atomic Weights to Commission members for suggestions or additions. He noted that there was never even a discussion about these disputed names. The procedure in place was that the Commission members would approve the table with all of the chemical names, as they were used in English in this English text of the report. The various members would use the element names favored in their own country, when they translated this table into other languages. Since there had previously never been an occasion for IUPAC to insist on a single name in all languages for each element, Baxter concluded his reply by suggesting to Wichers that he leave the matter of the element names to the Nomenclature Committee and would avoid any possible international trouble⁴.

From the above discussion, it can be seen that the Atomic Weights Commission never made an official decision on the names of the elements. However, the names listed in the Table in a particular country corresponded to those, which were commonly used and accepted for the element in that country and to this extent, the appearance of an element in the Atomic Weights Table was an implicit acknowledgment that IUPAC accepted that

particular element. The Commission avoided the potential problem of an initially false discovery of an element in the following manner. No element would be listed in the Atomic Weights Table until a measurable amount of that element had been separated and a value measured for its atomic weight. This process usually took a considerable number of years, by which time any potential problems or controversies with the discovery of the element were usually apparent in the scientific literature.

It will be seen that in 1949, the Atomic Weights Commission ceded the responsibility for the names of the chemical elements to the CNIC, where it remained until 2001 when IUPAC was reorganized and when IUPAC terminated the CNIC and almost all of the other IUPAC Commissions. The previous responsibility for the names of the chemical elements was transferred to the Inorganic Chemistry Division Committee (Division II). All of the previous nomenclature and terminology work that was being done in IUPAC was consolidated within a new Division of Chemical Nomenclature and Structure Representation (Division VIII).

The 15th IUPAC Conference

During the 1949 Conference, there was a joint meeting of the two Commissions, CNIC and Atomic Weights, to deal with element names. In addition to the beryllium/glucinium controversy, there were other elements for which two separate names were being used internationally. The other elements included niobium/columbium, cassiopeium/lutetium, celtium/hafnium and tungsten/wolfram. The discussion led to a general recommendation (which was subsequently incorporated into the 1957 Rules of the CNIC) that the old custom of allowing the right of naming of a new element to rest with the first discoverer should be abandoned, since it had resulted in many useless controversies and a principle of general acceptability should be used. Some examples of the problems that resulted from this practice of allowing the discoverer to name a new element can be seen from a review of the History of the Chemical Elements⁵. For general acceptability, the issues that were considered in the meeting included which name had the more widespread use in science, the priority of discovery and the number of languages in which the disputed names were used.

One outcome from this meeting was that in the future, the Atomic Weights Commission would withdraw from any further discussion about the names of the chemical elements. A second outcome of the meeting was that names would be recommended for the more recently discovered elements, technetium, promethium, astatine, francium, neptunium, plutonium, americium and curium. In addition, the names of beryllium, niobium, lutetium, hafnium, and wolfram were recommended for the cases of the disputed names, where two or more names were current. For element 91, the name protactinium was recommended to replace the previous name of protoactinium. Finally, the name lutetium from the Latin name of Paris, Lutetia, had been preferred to lutecium, from the French equivalent name of Paris, Lutece.

The Specific Case of Wolfram/Tungsten

During the course of the 1949 discussion, the subject of wolfram versus tungsten was raised, although this case was quite different from that for which the new principle had been enunciated. In this instance, the problem arose because in Scandinavian languages the word tungsten (or local variations) signifies “heavy stone” and this name seemed to be inappropriate for designating an element. Against this statement, it was argued that wolfram had long been accepted as the name of a particular mineral.

It was eventually suggested that the name wolfram should be recommended as the scientific name for the element, while the name tungsten could be retained, where desired, for commercial use, in analogy with the word “steel” for many commercial forms of “iron”. These suggestions from the 1949 meeting were followed by considerable correspondence from many parts of the world, which did not reveal any clear consensus.

These issues were reconsidered again by the CNIC at the 1951 IUPAC Congress. After studying the correspondence, Commission members agreed to leave the suggestions as they stood, with the name wolfram for element 74, in the hope that merit of uniformity in chemical nomenclature would gain recognition when the underlying reasons for the proposed change became generally understood.

Unfortunately, the 1951 Commission meeting of the CNIC was held in conjunction with the American Chemical Society’s (ACS) Centennial celebrations and unlike previous Commission meetings, it received much more attention from the press. Before the CNIC sessions were completed and long before the Commission’s report had been prepared for the IUPAC Council’s approval and its subsequent publication, a report appeared in the press suggesting that the Commission had decreed the abolition of the name tungsten. This report was completely in error, but it provoked a storm of protest from all over the world. Although efforts were made to correct the error, much harm was done to the standing of the Nomenclature Commission. The CNIC decided to recognize both names. At the 1953 meeting of the CNIC, it was decided to let the whole matter drop until a fresh review of the matter could be made under calmer conditions.

Since 1953, the CNIC Commission has been very fully occupied in dealing with the many nomenclature problems brought about by the rapid and extensive developments in inorganic chemistry and it has not been possible to undertake a fresh look at the wolfram-tungsten question⁶. It could be seen from the 1970 edition of the Nomenclature rules that both forms, wolfram and tungsten, were provided for in the rules as alternative names for the element.

Although the responsibility for the names of the chemical elements in IUPAC passed from the CNIC to the Inorganic Chemistry Division Committee, Division II, the recent change in the element name was made by Division VIII, without notifying or consulting the sole IUPAC authority responsible for the names, the Division II Committee.

Side Note on a Spanish Member of the Atomic Weights Commission

I might note that Enrique Moles, who was a Professor at Madrid University and had been an IUPAC Vice-President during the period of the 1930s, was invited to attend the 1949 reorganization meeting of the Atomic Weight Commission because of his known interest in atomic weights. Professor Moles was elected to the Commission at the meeting and he was chosen as the Secretary-Reporter. At the meeting, Moles proposed a table, which included the element, tungsten, with the symbol W and without any mention of wolfram, since the table for the report was prepared in English. In November 1949, when Wichers sent the final version of the report on atomic weights to the IUPAC Council, it included the element name, wolfram, with the symbol W and a reference to the IUPAC Nomenclature Commission making the change. In the 1949 Report of the Atomic Weight values in the USA⁷, the names and symbols adopted by IUPAC were used but as a concession to the fact that the new names were unfamiliar in the United States (and may not find acceptance there), the old names of columbium and tungsten were also given for the elements 41 and 74, respectively. In the 1951 Report of the Atomic Weight values in the USA⁸, the name wolfram, as the preferred name of the element more commonly known as tungsten in the English speaking countries has been dropped from the table because it failed to gain acceptance in the United States (see the above note on the uproar in the USA press over the elimination of tungsten). It was noted in the report that IUPAC now recognized both names of tungsten and wolfram.

I might note that some forty years after the decision had been made by the CNIC on the preferred element names, metallurgists in the USA were writing to ask me why the name columbium, which was used by metallurgists throughout the USA, was not listed in the Atomic Weights Table in English.

Conclusions

From the above history of the wolfram-tungsten affair, it can be seen that a special set of circumstances was involved in the resolution of the disputed names for element 74 some sixty years ago. Under these circumstances of bowing to the public pressure of the press in the USA, the 1970 edition of the Nomenclature rules allowed the use of both of the names, wolfram and tungsten. As the nomenclature rules change with time, the choice of using either name for element 74 as a compromise has now been withdrawn by IUPAC. However, a half-century after the controversy, probably much of this history has been lost and is now forgotten by the people who were involved in making this recent decision.

On the other hand, the thinking involved has also evolved during this period. As Ture Damhus has noted⁹, the recommended chemical names are now those names as used in English, which is the one official language of IUPAC¹⁰. Damhus also noted that there is still the option of using other names in various other national nomenclatures (at least for the time being). Whether this option will remain as rules continue to evolve in the future is not clear.

As a final note, I would also mention that if these present rules had been in place in 1949, the name for element 41 would probably now be columbium and not niobium. However, nomenclature rules evolve over time and one should not try to impose rules from one time era to decisions that were made during another time era. Whether the origin of the dispute over wolfram and tungsten would justify the retention of wolfram as an alternate name for element 74, only time will tell.

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