Chinese Terms for Chemical Elements

Characters Combining Radical and Phonetic Elements

by Chang Hao

When a chemical element is translated into Chinese, the character usually contains a radical that indicates the physical properties of the element according to the Chinese philosophy of nature. This idea dates back to the year 1871. For example, the term argon was translated into *ya* with an air-radical, barium into *bei* with a metal-radical, and so on.

The Chinese language has very little in common with European languages. When the nineteenth-century Chinese translated chemical elements that had been named after countries, places, their form, or their distinctive properties, tremendous effort was required to create a whole nomenclature from scratch.

The modern concept of a chemical element as a "substance that cannot be split up by any known means into something simpler" did not exist in traditional Chinese natural philosophy. When the concept of the four elements was introduced into China in the late Ming dynasty (1368–1644), the translation *yuanxing* (original-phase) for the term "element" was influenced by the theory of the five phases. There are five *xing* (phases) in China, namely, metal, wood, water, fire, and earth, which have an interdependent cyclic relationship. In the Chinese view of nature, fire represents not only the real fire, but also the substances bearing characteristics of fire. Although there were different Chinese translations for "element" in the nineteenth-century, those terms are mostly forgotten nowadays. Only the word *yuansu* (original-element), which is derived from the Japanese language and was introduced into China after the Sino-Japanese war (1894–95), is still in use today.

Although the introduction of modern Western chemistry into China began in the middle of the nineteenth century, a large number of theories were not translated into Chinese until the 1870s. The translation of the elements was one of the earliest problems, especially when it came to explaining the reaction of substances. The use of traditional, already existing Chinese names was in the beginning considered an advantage. However, only a few terms could be used for the new elements. There weren't many chemists in nineteenth-century China, so translating chemical terms was a big problem. Most translators were not experts and they didn't know anything about the chemical properties of an element, which often made their translations misleading. Others just put the pronunciation of the English terms into Chinese characters, a method that was temporarily accepted, but the resulting words didn't sound very Chinese and couldn't convey any real information about the element to which they pointed.

In 1871, John Fryer (1839–1928) and his Chinese colleague Xu Shou (1818–1884), both of them working for the translation office of the Jiangnan Arsenal, created a principle for the translation of chemical elements according to which one Chinese character was to be assigned to each element. The impact of their translations on the fields of chemistry and chemical engineering proved to be enormous. In *Huaxue Jianyuan* (*Mirror of Chemical Science*), the most influential textbook on chemistry in nineteenth-century China, Fryer and Xu explained their ideas on the translation of the elements. Traditional terms for elements like gold, silver, copper, iron, lead, tin, mercury, sulfur, phosphorus, and carbon remained unchanged. If they considered an existing term for an element suitable (examples are oxygen, hydrogen, and nitrogen), it was retained as well. They would not translate according to the mere meaning of a term, because this was often hard to determine. For the

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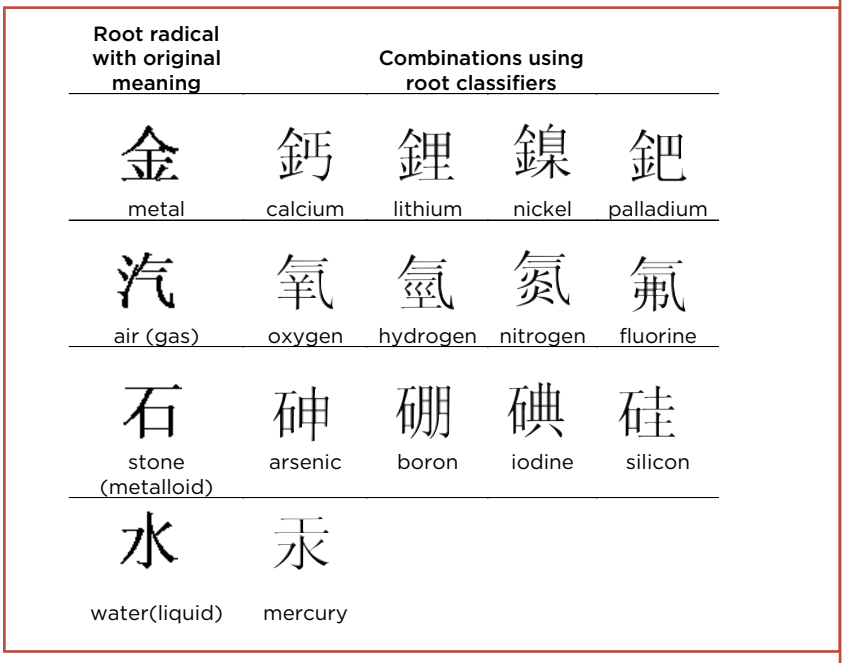
H	He	Li	Be	B	C	N	O	F	Ne
氫	氦	鋰	鈹	硼	碳	氮	氧	氟	氖

Chinese characters for some of the elements.

other elements, they created new characters. Their method consisted of translating the pronunciation of the first syllable of the original term. If this was not suitable, they translated the second syllable, and combined it with the radical in order to indicate the properties of the element. The character's pronunciation could then be ascertained by looking at the phonetic part. Fryer and Xu emphasized that they would not directly translate the sound of the Western terms. These long rows of Chinese characters were purely onomatopoetic and were not only a great burden to read, write, or remember, but they had no meaning whatsoever.

Except for 9 Chinese traditional terms and 5 accepted translations, Fryer and Xu invented 50 of the 64 characters for chemical elements. Forty-eight of them were composed of a root and the sound of one syllable of the original English term. Fryer and Xu's method was a considerable challenge to their contemporaries. Using traditional names was the preferred translation method of the time, since these terms were easily accepted by the Chinese. For example, the terms for aluminum, arsenic, boron, calcium, potassium, silicon, and sodium had been translated by others using traditional Chinese names or other already established terms.



One Chinese character is assigned to each element; this is a compound character in two parts: (1) a root radical, classifying the element as of the "metal," "air," "stone," or "water" groups: (2) a single descriptive word or an imitation of the sound of one syllable in the English name of the element.

Fryer found both the use of established terms or invented characters difficult. He once described his decision on the translation method as being a choice between "two evils." Philologists would criticize the "incorrect" use of traditional terms and on the other hand, Chinese patriots would condemn the use of terms that too clearly derived from products of Western science. In order to avoid such misunderstandings, Fryer chose to invent new characters that hadn't existed in any Chinese dictionary. However, the disadvantage of such invented characters was that they were not officially authorized and therefore not easily accepted.

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However, Fryer and Xu's principle of character creation was soon widely accepted by their contemporary translators. But many of their phonetic-based terms were also criticized. Many Chinese found Fryer and Xu's terms awkward, and the missionary translators considered them inconvenient. In T*he Revised List of Chemical Elements*, most terms were translated as descriptive names. This list of elements was published in 1898 and was the first achievement of the Educational Association of China, which strived to create a Chinese scientific terminology. In determining these names, the Committee on the Nomenclature of the Educational Association stated its conviction that the terms should tell something about the properties of an element rather than imitate its original pronunciation. Only in the early twentieth century did Fryer's phonetic names eventually gain

acceptance. Fryer himself had predicted that it would take a while for his creations to become widely accepted.

In 1915, the Ministry of Education published a list of the names of elements based on Fryer and Xu's terms. Two years later, the General Committee on Scientific Terminology, which was appointed by the Chinese Government to translate scientific terminology, adopted most of their names for the chemical elements.

During the process of unifying the Chinese chemical nomenclature, the cooperation between the National Institute for Compilation and Translation and the Chinese Chemical Society played a significant role. The Institute was established in 1932 with the task of unifying school textbooks and scientific terminology. The same year, the Ministry of Education organized a chemistry forum where issues regarding the translation of chemical terms, chemistry education, and chemical engineering in the military were discussed. One result of the forum was the establishment of the Chinese Chemical Society. The chemical terms that were agreed upon in the forum laid the foundation for a commonly accepted terminology. One year later, the National Institute for Compilation and Translation published *Principle of the Chemical Nomenclature* in which the names of chemical elements were standardized. Most of the chemical terms are still in use today. The value of Fryer and Xu's work had finally been recognized.

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Today in Taiwan, the Nomenclature Committee of the Chinese Chemical Society is appointed by the Ministry of Education to draw up a standard list of chemical terms in Chinese. For example, darmstadtium (Ds), element 110, has been translated as *da* according to the first sound of its term.

Oxygen, Hydrogen, and Nitrogen

Apart from studying the historical development of the translation of chemical elements, the Chinese names for oxygen, hydrogen, and nitrogen are also worth investigating. Since their first translations in 1855, the terms *yangqi* (nourishing gas), *qingqi* (light gas), and *danqi* (diluting gas)—oxygen, hydrogen, and nitrogen, respectively—had been applied by Fryer and Xu and became widely accepted in the nineteenth century. During that time, *yang* (nourishing), *qing* (light), and *dan* (diluting) were considered more suitable and more elegant than the translations derived from the German terms *sauerstoff*, *wasserstoff*, and *stickstoff*. In the twentieth century, many Chinese scholars thought that *yang*, *qing*, and *dan* were also more suitable than the Japanese terms *sanso* (acid element), *suiso* (water element), and *sasso* (lethal element), which also derived from the Germano-Dutch nomenclature. The historical record of the translations of these three elements shows that Lavoisier's chemical theories and nomenclature were never fully accepted in China. It also demonstrates the extreme difficulties the Chinese encountered trying to understand Western chemistry.

In its ancient past, China's chemistry was basically alchemy, and only a few names for new elements could be taken from the alchemical vocabulary. The Chinese naturally preferred descriptive terms whenever possible, but there are only five such terms. Many new terms for chemical elements have become a natural part of the Chinese language, which today proves to be more open toward importing new ideas and concepts. And the work of Fryer and Xu is still bearing fruit: The 44 terms they conceived continue to be in use today.

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Pronunciation Guide

In Chinese, different characters are often pronounced the same way. Even though the four tones serve as a means of distinction, the Chinese usually distinguish the characters by their forms. In the table of chemical elements 12 terms derive from traditional names: carbon, sulfur, iron, copper, silver, tin, gold, mercury, lead, boron, phosphorus, and platinum. A number of terms carry a "gas" radical: hydrogen, nitrogen, oxygen, fluorine, chlorine, helium, neon, argon, krypton, xenon, and radon. Other terms have an "earth" radical: carbon, boron, silicon, phosphorus, sulfur, arsenic, selenium, tellurium, iodine, and astatine. The "water" radical was attributed to the following elements: bromine, mercury. The rest of the elements have a "metal" radical. The second part of the characters is phonetic and provides a hint to the pronunciation of the term.

Atomic number	Element	Pronunciation of the character	Atomic number	Element	Pronunciation of the character
1	Hydrogen	*qing*	56	Barium	*bei*
2	Helium	*hai*	57	Lanthanum	*lan*
3	Lithium	*li*	58	Cerium	*shi*
4	Beryllium	*pi*	59	Praseodymium	*pu*
5	Boron	*peng*	60	Neodymium	*nyu*
6	Carbon	*Tan*	61	Promethium	*po*
7	Nitrogen	*dan*	62	Samarium	*shan*
8	Oxygen	*yang*	63	Europium	*you*
9	Fluorine	*fu*	64	Gadolinium	*ga*
10	Neon	*nai*	65	Terbium	*te*
11	Sodium	*na*	66	Dysprosium	*di*
12	Magnesium	*mei*	67	Holmium	*huo*
13	Aluminium	*lyu*	68	Erbium	*er*
14	Silicon	*Xi*	69	Thulium	*diou*
15	Phosphorus	*lin*	70	Ytterbium	*yi*
16	Sulphur	*liu*	71	Lutetium	*liu*
17	Chlorine	*lyu*	72	Hafnium	*ha*
18	Argon	*ya*	73	Tantalum	*tan*
19	Potassium	*jia*	74	Tungsten	*wu*
20	Calcium	*gai*	75	Rhenium	*lai*
21	Scandium	*kang*	76	Osmium	*er*
22	Titanium	*tai*	77	Iridium	*yi*
23	Vanadium	*fan*	78	Platinum	*bo*
24	Chromium	*ge*	79	Gold	*jin*
25	Manganese	*meng*	80	Mercury	*gong*
26	Iron	*tie*	81	Thallium	*ta*
27	Cobalt	*gu*	82	Lead	*qian*
28	Nickel	*nie*	83	Bismuth	*bi*
29	Copper	*tong*	84	Polonium	*pu*
30	Zinc	*xin*	85	Astatine	*e*
31	Gallium	*jia*	86	Radon	*dong*
32	Germanium	*zhe*	87	Francium	*fa*
33	Arsenic	*shen*	88	Radium	*lei*
34	Selenium	*xi*	89	Actinium	*a*
35	Bromine	*chou*	90	Thorium	*tu*
36	Krypton	*ke*	91	Protactinium	*pu*
37	Rubidium	*ru*	92	Uranium	*you*
38	Strontium	*si*	93	Neptunium	*nei*
39	Yttrium	*yi*	94	Plutonium	*bu*
40	Zirconium	*gao*	95	Americium	*mei*
41	Niobium	*ni*	96	Curium	*ju*
42	Molybdenum	*mu*	97	Berkelium	*bei*
43	Technetium	*ta*	98	Californium	*ka*
44	Ruthenium	*liao*	99	Einsteinium	*ai*
45	Rhodium	*lao*	100	Fermium	*fei*
46	Palladium	*ba*	101	Mendelevium	*men*
47	Silver	*yin*	102	Nobelium	*nuo*
48	Cadmium	*ge*	103	Lawrencium	*lao*
49	Indium	*yin*	104	Rutherfordium	*lu*
50	Tin	*xi*	105	Dubnium	*du*
51	Antimony	*ti*	106	Seaborgium	*xi*
52	Tellurium	*di*	107	Bohrium	*po*
53	Iodine	*dian*	108	Hassium	*hei*
54	Xenon	*shan*	109	Meitnerium	*mai*
55	Caesium	*se*	110	Darmstadtium	*da*