Lithium

Lithium under argon. Size of the largest piecem: 0.3 x 4cm. @ images-of-elements.com

Lithium, the lowest density metallic element, is in a group of elements called alkali metals or *Group I elements* and is silvery-white in color. It has the atomic number of 3. The alkali metals group includes lithium (Li), sodium(Na), potassium(K), rubidium(Rb), cesium(Cs). The three alkali metals are highly reactive with oxygen and water, so they are typically stored in oil. Although lithium will react dramatically when placed in water, it is the least reactive alkali metal. When it reacts with water it bounces on the top of the water because it is less dense than water and because of the robustness of the reaction. Johan A. Arfvedson, of Stockholm, Sweden, first discovered lithium in the year 1817. It was first isolated by W.T. Brande and Humphry Davy in the 19th century, but it was not commercially produced until 1923.

Spodumene. Source: Mineral Information Institute

Name

Previous Element: Helium **Next Element: Beryllium**	3 **Li** 6.941
Physical Properties	
Color	Silvery
Phase at Room Temp.	solid
Density (g/cm^3)	0.534

Hardness (Mohs)	.6
Melting Point (K)	453.74
Boiling Point (K)	1620
Heat of Fusion (kJ/mol)	4.6
Heat of Vaporization (kJ/mol)	148
Heat of Atomization (kJ/mol)	161
Thermal Conductivity (J/m sec K)	84.8
Electrical Conductivity (1/mohm cm)	107.8
Source	Spodumene (silicate)
Atomic Properties	
Electron Configuration	$[He]2s^{1}$
Number of Isotopes	2
Electron Affinity (kJ/mol)	59.63
First Ionization Energy (kJ/mol)	520.2
Second Ionization Energy (kJ/mol)	7394.4
Third Ionization Energy (kJ/mol)	11814.6
Electronegativity	0.98
Polarizability ($Å^{3}$)	24.3
Atomic Weight	6.941
Atomic Volume (cm^{3}/mol)	13
Ionic Radius^{2-} (pm)	---
Ionic Radius^{1-} (pm)	---
Atomic Radius (pm)	152
Ionic Radius^{1+} (pm)	90
Ionic Radius^{2+} (pm)	---
Ionic Radius^{3+} (pm)	---
Common Oxidation Numbers	+1
Other Oxidation Numbers	-1
Abundance	
In Earth's Crust (mg/kg)	2.0×10^{1}
In Earth's Oceans (mg/L)	1.8×10^{-1}
In Human Body (%)	0.00001 %
Regulatory / Health	
CAS Number	7439-93-2
OSHA Permissible Exposure Limit	No limits
OSHA PEL Vacated 1989	No limits
NIOSH Recommended Exposure Limit	No limits
Sources: Mineral Information Institute Jefferson Accelerator Laboratory	

The name*lithium* comes from the Greek word *lithos*which means *stone* because lithium was first discovered in rocks and the other two alkali metals were first discovered inplants. Lithium was first found in the mineral called petalite ($LiAl(Si_2O_5)_2$, lithium aluminum silicate. Petalite is found in the minerals spodumene, lepidolite mica, and amblygonite.

Sources

Some lithium is recovered from the mineral spodumene. Commercial quantities of spodumene are in a specialigneous rock deposit that geologists call a*pegmatite*. In pegmatites, the liquid rock (magma) cools so slowly that crystals have time to grow very large. The largest spodumene crystal ever found was found in a pegmatite in South Dakota.

Most lithium is recovered from *brine*, or water with a high concentration of lithium carbonate. Brines trapped in the Earth's crust (called subsurface brines) are the major source material for lithium carbonate. These sources are less expensive to mine than from rock such as spodumene, petalite, and other lithium-bearing minerals.

It is estimated that the United States has approximately 760,000 tons of lithium reserves. The resources in the rest of the world are estimated to total 12 million tons. The United States is the world's leading consumer of lithium and lithium compounds. The leading producers and exporters of lithium ore materials areChile and Argentina. China and Russia have lithium ore resources, but it is presently cheaper for these countries to import this material from Chile than to mine their own reserves.

Biological interactions

Trace amounts of lithium are present in the world's oceans and in some organisms, although the element serves no apparent vital biological function in humans. The lithium ion Li^+ administered as any of several lithium salts has proved to be useful as a mood stabilizing substance, becuase of neurological effects of Lithium ion in the human body.

Industrial uses

More than one-half of the lithium compounds consumed are used in the manufacture of glass, ceramics andaluminum. Lithium is also used in making synthetic rubber, greases and other lubricants.

Lithium batteries are increasingly being invoked as an alternative to traditional batteries, and also in new battery applications such as electric carbatteries, although costs can be quite high. Lithium is mixed with other light metals such as aluminum and magnesium to form strong, light-weight alloys (an *alloy*is a mixture of metals). Some lithium, in the form of lithium carbonate or lithium citrate, is used as medicine to treat gout (an inflammation of joints) and to treat some syndromes of mental illness.

Nuclear Applications

Lithium-6 can be employed as a source of tritium, as well as a neutron absorber in nuclear fusion reactions. Naturally occurring lithium contains about seven and one half percent ^6Li, from which extensive amounts of ^6Li have been produced by isotope separation for use in nuclear weaponry. ^7Li subsequently gained traction in its viability as a nuclear reactor coolant.

In the early development of hydrogen bomb technology, lithium deuteride was a favored nuclear fusion fuel. Upon bombardment by neutrons, ^6Li and ^7Li each emit tritium; this reaction, not fully understood at the time of the Teller-Ulam design, was responsible for the out of control yield in an early hydrogen bomb test. Tritium fuses with deuterium in a nuclear fusion reaction.

Substitutes and Alternative Sources

Potassium compounds can be used in glass and ceramic production. Greases can be made using calcium soaps, for example, in place of lithium compounds. In some cases, glass, polymers and resins can be used in place of aluminum-lithium alloys. Zinc, magnesium, nickel and cadmium, and even mercury, can be used to make batteries in place of lithium. (It must be noted that mercury is being phased out of use due to the fact it is so poisonous.)

Further Reading

- Robert E.Krebs. 2006. *The History and Use of Our Earth's Chemical Elements: A Reference Guide*. Westport, Conn.: Greenwood Press. ISBN 0-313-33438-2
- D.R.Lide, ed. 2005. *CRC Handbook of Chemistry and Physics* (86th ed.). Boca Raton (FL): CRC Press.
- Common Minerals and Their Uses, Mineral Information Institute.
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- Norman N.Greenwood and A.Earnshaw. 1984. Chemistry of the Elements. Oxford: Pergamon. ISBN 0-08-022057-6

Source:
http://www.eoearth.org/view/article/51cbee587896bb431f6972d4/?topic=51cbfc79f702fc2ba8129ed6