CHAPTER XXXIII

METALLURGY OF LITHIUM

Source: Metallurgiya legkikh Metallov, Metallurgizdat, pp. 542-543, (Ch. XXXIII).

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117. Properties and Uses of Lithium

Lithium is the lightest of all metals; its specific gravity is 0.534, or only a little over half that of water. Therefore lithium floats in gasoline.

In table 87 are given some of lithium's properties.

Table 87

PROPERTIES OF LITHIUM

PROPERTY	VALUE
Atomic weight	6.940
Valence	1
Specific gravity at 20 degrees	0.534
Melting Point (degrees)	180
Boiling Point (degrees)	1330
Electrode potential relative to the hydrogen electrode	-3.09
Electrochemical equivalent, grams per ampere-hour	0.259

Lithium is slightly harder than sodium, but not so easily sliced as the latter. At high temperatures, lithium, like magnesium, ignites with a bright flash and releases considerable heat. Metallic lithium forms one component in the light alloy, Scleron - a substitute for brass. Scleron is composed of the following: 12 percent Zn; 3 percent Cu; 0.6 percent Mn; 0.5 percent Si; 0.4 percent Fe and 0.1 percent Li; the balance is aluminum.

Recently lithium has been also used as a deoxidizing (reducing) agent of copper and as such has the valuable property of increasing electrical conductivity of the latter.

118. Preparation of Metallic Lithium

Metallic lithium is obtained by electrolyzing melted lithium chloride or a mixture of $LiCl + KCl$. Lithium was first obtained through electrolysis of LiCl in 1854 by Bunsen and Mattisen.

The preparation of anhydrous lithium presents certain difficulties.

As source materials the following lithium-bearing minerals are used: Spodumene LiAL $(SiO_3)_2$, or lepidolite $KLiF_2 \cdot Al_2O_3 \cdot 3SiO_2$ which contains half as much lithium as the spodumene, but is easier to re-process in LiCl.

Li_2CO_3 is first prepared from the above ores and then dissolved in pure hydrochloric acid. The resulting lithium chloride is then thoroughly purified and crystallized as $LiCl \cdot 3H_2O$. The dehydration of this salt is attended by the same difficulties encountered during dehydration of the hexahydrate of magnesium chloride and requires approximately the same conditions. The electrolysis of lithium chloride can be accomplished in tubs used for the preparation of magnesium or sodium and the separated lithium can be extracted from the tub in melted condition without appreciable losses due to oxidation by the air. According to the Gintsvetmet method (Nonferrous Metals, No 4, 1932, 636; Rare Metals, No 3, 1934, 40), for example, the tub represented in Figure 216 (Electrolyzer for Preparing Metallic Lithium) serves as an electrolyzer.

The latter consists of an iron housing lined with talc stone (schist) roasted at about 900 degrees /Centigrade/. The cathodic and anodic areas are separated by an alundum partition not quite reaching to the bottom. An iron cathode runs along the floor of the tub; a carbon bar dipping into the electrolyte from above serves as the anode.

For an electrolyte is used a mixture of equal parts by weight of LiCl and KCl which have a melting temperature of about 350 degrees. The extracted lithium rises to the surface of the electrolyte and gathers under the lid covering the cathodic area. Into the anodic area additional dehydrated lithium chloride is periodically introduced. The lithium from the cathodic area is scooped out with iron spoons and poured into pigs. The metal thus obtained - in order to be freed from accidental occlusions - is remelted in vaseline oil at 200 degrees, and is preserved in jars with kerosene or petroleum ether. In a 400 volt electrolyzer the yield of lithium is about 75 percent of that expected from the current. Under a potential of 13 volts in the bath, the power consumption is 66 kilowatt hours to 1 kilogram of lithium. The purity of the metal obtained is up to 99 percent. The principle secondary components are: Potassium (up to 0.3 percent and traces of sodium, silicon, aluminum, iron and magnesium.

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