



Potassium (K¹⁹)

Properties

Potassium is a silvery-white, alkaline metal with an atomic mass of 39.098 u. Potassium has a density of 0.862 g/cm³, a melting point of 63.5 °C and a resistivity of 72 μOhm cm. It is very soft and has a Brinell hardness of 0.363 MPa.

Elemental potassium never occurs freely in nature as it is very reactive and reacts with oxygen in air to form potassium peroxide. Elemental potassium was first isolated by electrolysis of molten KOH with the newly discovered voltaic pile.

Potassium in its compounds shows +1 and -1 oxidation states. Its standard electrode potential in respect to K⁺ is -2.93 V. Potassium reacts violently with oxygen to form potassium peroxide, and with water to form hydrogen gas and potassium hydroxide. The reaction of potassium with water is dangerous because of its violent exothermic character and the production of hydrogen gas.

Plating Solutions

Potassium compounds can be electroplated in organic electrolytes, consisting of potassium bis(fluorosulfonyl)imide, KFSI) or 0.5 mol dm⁻³ KPF₆ dissolved in ethylene carbonate at temperature of 25 °C and current density of 0.1 mA/cm² [1].

It is also can be plated from KClO₄ solutions in propylene carbonate. The bath can be made of 0.1 M KClO₄ solutions in propylene carbonate and the plating is performed at room temperature with a current density of 0.1 mA/cm² [1].

Applications

There are many of uses of various potassium compounds. Potassium chloride (KCl) and potassium hydroxide (KOH) are the most common potassium compounds. KCl is used in fertilizers, as a salt substitute and to produce other chemicals. KOH is used to make soaps, detergents, drain cleaners and to produce other chemicals such as potassium carbonate (which is used primarily in the manufacture of specialty glasses) and potassium phosphates (which find markets primarily as builders in industrial detergents and cleaners, and in water treatment chemicals). Other end uses for potassium hydroxide include electroplating, herbicides, greases, catalysts, oxidizers, medicines, and alkaline-electrolytic batteries. Potassium hydroxide is also used as a direct intermediate for several potassium chemicals, including potassium cyanide, aluminate, formate, fluosilicate, borohydride, bromate, bromide, gluconate, laurate, manganate, oleate, and titanate. Potassium superoxide (KO₂) is being used as a portable source of oxygen in respiration systems in mines, submarines and spacecraft as it takes less volume than the gaseous oxygen. It is also being used for new generation of batteries high-voltage/high-power potassium-ion batteries and potassium-ion capacitors [2].

References:

- [1] S. Komaba, T. Hasegawa, M. Dahbi, and K. Kubota. *Electrochem. commun.* **60**, 172–175, 2015.
- [2] M. Moshkovich, Y. Gofer, and D. Aurbach. *J. Electrochem. Soc.* **149** (2), A115-A121, 2002.

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