



Iridium (Ir⁷⁷)

Properties

Iridium is a silvery-white metal with an atomic mass of 192.2 u. Ir has a density of 22.56 g/cm³, a melting point of 2446 °C and a resistivity of 4.71 μOhm cm. It is very hard & brittle with a Brinell hardness of 980 – 1350 MPa and Young's modulus of 528 GPa. Iridium's modulus of elasticity is the second-highest among the metals, only being surpassed by osmium. This, together with a high shear modulus of 210 GPa and a very low figure for Poisson's ratio of 0.26, indicate the high degree of stiffness and resistance to deformation that have rendered its fabrication into useful components a matter of great difficulty.

The most common compounds have Ir in the +3 and +4 states, while it also exists in other oxidation states such as -3, -1, +2, +5, +6, +7, +8, +9. Its standard electrode potential in respect to Ir⁺³ is +1.0V. Iridium is the most corrosion-resistant metal known. It is not attacked by almost any acid, aqua regia, molten metals, or silicates at high temperatures. It can, however, be attacked by some molten salts, such as sodium cyanide and potassium cyanide, as well as oxygen and the halogens (particular fluorine) at higher temperatures. Iridium also reacts directly with sulfur at atmospheric pressure to yield iridium sulfide. Ir is one of the rarest elements with estimated average concentration of 0.4 parts per billion (ppb) in the Earth's crust.

Plating Solutions

Rhodium can be electrochemically deposited from aqueous electrolytes^[1-5], containing in g/l:

- Example #1. Ammonium hexachloroiridate – 7, sulfuric acid – 0.7 at pH 1.4-1.7, temperature of 18-21 °C and current density of 1 mA/cm² with current efficiency of 20-30%.
- Example #2. Iridium chloride tetrahydrate – 10, sulfonic acid – 35 at temperature of 50-80 °C and current density of 2 – 6 mA/cm².

Iridium can be also electrodeposited from melts of cyanide salts, consisting of 70wt.% sodium cyanide and 30wt% potassium cyanide at temperature of 600-700 °C, current density of 10 – 45 mA/cm² with current efficiency of ~100%.

Electrodeposition of pure iridium can be also performed in 1-butyl-3-methylimidazolium tetrafluoroborate ionic liquid (BMIMBF₄) at temperature of 120 °C in the argon atmosphere with the current densities ranges from 5 mA/cm² to 18.2 mA/cm²^[6].

Applications

Iridium major use is as hardening agent for platinum alloys. With osmium, it forms an alloy that is used for tipping pens, and compass bearings. It is also used to make heavy-duty electrical contacts. Other major applications include spark plugs and chemical catalysts.

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