NANO3D SYSTEMS LLC
1110 NE Circle Blvd., ATAMI/Bldg. 11, Corvallis, Oregon 97330-4254
T 503-927-4766| F 541-758-9320| http://www.nano3dsystems.com

Beryllium (Be^4)

Properties

Beryllium is a white-gray metal with an atomic mass of 9 u. Be has a density of 1.85 g/cm^3, a melting point of 1287 ^{o}C and a resistivity of ~3.6 µOhm cm. It has exceptional stiffness (Young modulus of 287 GPa) and a Brinell hardness of 590 – 1320 MPa. Other significant properties are high specific heat (1925 $J \cdot kg^{-1} \cdot K^{-1}$) and thermal conductivity (216 $W \cdot m^{-1} \cdot K^{-1}$), which make beryllium the metal with the best heat dissipation characteristics per unit weight.

Beryllium is a toxic bivalent element. Its standard electrode potential in respect to Be^{+2} is -1.85V. Atmospheric passivation gives beryllium excellent corrosion resistance. Be can be dissolved in bases and acids. However, it is only dissolved in concentrated nitric acid at elevated temperature. Beryllium has a concentration of 2 to 6 parts per million (ppm) in the Earth's crust.

Plating Solutions

Organic solvents are useful in the deposition of reactive metals such as Be, Al and the alkali metals which cannot be deposited from aqueous solutions because their electrode potentials are higher than that of hydrogen [1]. Beryllium can be electrodeposited from non-aqueous ethyl ether solutions, containing in g/l: dimethyl beryllium - 120, beryllium chloride – 115 at current density of 1 – 1.5 mA/cm^2 or diethylchloride beryllium – 610 at current density of 10 mA/cm^2.

Beryllium can be also electrodeposited from molten salts, containing chloride of alkali metals with beryllium fluoride and beryllium oxyfluoride at temperature of 700 – 800 ^{o}C and current density of 1000 mA/cm^2.

Applications

Because of its low atomic number and very low absorption for X-rays, the oldest and still one of the most important applications of beryllium is in radiation windows for X-ray tubes. Because of its stiffness, lightweight and dimensional stability over a wide temperature range, beryllium metal is used for lightweight structural components in the defense and aerospace industries in high-speed aircraft, guided missiles, spacecraft, and satellites. Mixing about 2.0% beryllium into copper forms an alloy called beryllium copper that is six times stronger than copper alone. Beryllium alloys are used in many applications because of their combination of elasticity, high electrical and thermal conductivity, high strength and hardness, nonmagnetic properties, as well as good corrosion and fatigue resistance. These applications include non-sparking tools that are used near flammable gases (beryllium nickel), in springs and membranes (beryllium nickel and beryllium iron) used in surgical instruments and high temperature devices.

References:

1. S. Jayakrishnan, M. Pushpavanam, and B.A. Shenoi. *Surface Technology* **13** (3), 225 – 240, 1981.

CONTACT NANO3D SYSTEMS LLC TO FORMULATE BERYLLIUM PLATING SOLUTION PER YOUR REQUIREMENTS