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Tellurium (Te^{52})

Properties

Tellurium is a silvery-white metalloid with an atomic mass of 127.6 u. Te has a density of 6.24 g/cm^3 and a melting point of 450 ^{o}C. Tellurium is a p-type semiconductor with a narrow band-gap energy of 0.35V at room temperature. Owing to its crystal structure, tellurium exhibits many unique physical properties including photoconductivity, piezoelectric effect, gas sensing, and catalytic activity. It is soft and has a Brinell hardness of 180 – 3270 MPa.

Tellurium is chemically related to selenium and sulfur, all three of which are chalcogens. The most common compounds have Te in the +3 and +4 states, while Te also exhibits other oxidation states ranging from – 2 to +6. Its standard electrode potential in respect to Te^{+2} is +0.4V and Te^{+4} +0.57V. Tellurium will burn in air and oxygen. It is unaffected by water or hydrochloric acid, but nitric acid readily dissolves Te. With an abundance in the Earth's crust of ~0.005 ppm), tellurium is one of the rarest stable solid elements.

Plating Solutions

Tellurium can be electrodeposited from the aqueous solutions, both acidic (sulfuric, hydrofluoric, citric, nitric et al) [1-3] and alkaline [4, 5], containing in g/l:

a) Example #1. Tellurium dioxide – 300, hydrofluoric acid – 500, sulfuric acid - 200 at temperature of 20 – 30 ^{o}C and current density of 15 – 30 mA/cm^2.
b) Example #2. Compact semiconducting tellurium thick films (i.e., up to 50 μm) can be electroplated in alkaline bath at high rates (>100 μm h^{-1}) with great current efficiency (>85%) by optimizing the electrolyte composition (TeO_3^{2-} concentration and pH) and deposition potential.

Tellurium can be also deposited from ionic liquids and organic solutions, for example acidic choline chloride:urea and dimethyl sulfoxide (DMSO), respectively [6, 7].

Applications

The primary use of tellurium is copper (Tellurium Copper), iron, stainless steel, and lead alloys. The addition to steel and copper produces an alloy more machinable than otherwise. Applications in CdTe solar panels and semiconductors also consume a considerable portion of tellurium production. Other tellurides, such as $CuInTe_2$, PbTe, $Pb_{1-x}Sn_xTe$, Ag_2Te, Bi_2Te_3, and Sb_2Te_3 have found applications in high efficient solar cells, photo-diode devices, mixed ionic-electronic conductive and thermo-element materials [4, 8].

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