DOUGLAS DRENKOW
Research & Communications

http://DouglasDrenkow.com/write2g.html

Cesium and Rubidium in Ion-Propulsion Systems

A Contribution to *America at the Threshold: The President's Space Exploration Initiative*

1991

BRIEF DESCRIPTION: Because of their ease of oxidation and natural occurrence in and near the United States, the alkali metals cesium and rubidium are prime candidates for our use in ion-propulsion and other systems in space.

PERFORMANCE CHARACTERISTICS (Ref. 55th Edition of the *Handbook of Chemistry and Physics*): Cesium (atomic number 55) occurs in such minerals as "lepidolite" and "pollucite": At Bernic Lake, Manitoba, deposits contain perhaps 300,000 tons of pollucite, averaging twenty percent cesium. The price in 1974 of a pound of purified cesium was $100 to $150. Cesium is a silvery-white, soft, ductile, and liquid metal at room temperature. Cesium is the most electropositive and most alkaline element, reacting explosively with cold water and at some temperatures even reacting with ice; and cesium hydroxide is the strongest base known, attacking glass. In ion-propulsion systems in space—NOT usable in the Earth's atmosphere—one pound of cesium theoretically will propel a vehicle 140 times as far as the burning of the same amount of any known liquid or solid. Cesium can also be used in photoelectric cells, in atomic clocks, as a "getter" in radio tubes, and as a catalyst in the hydrogenation of certain organic compounds.

Rubidium (atomic number 37) is perhaps the sixteenth most abundant element in the Earth's crust, occurring in "pollucite" (as with cesium in Bernic Lake—above), "carnallite", "lepidolite", "leucite", and "zinnwaldite"; and potassium minerals, such as those found at Searles Lake, California, and potassium chloride recovered from brines in Michigan also contain the element and serve as commercial sources. In 1974 a pound of prepared rubidium cost approximately $300. Rubidium is a soft, silvery-white metal that can be liquid at room temperature. It is the second most electropositive and alkaline element, igniting spontaneously in air and reacting violently in water—rubidium must be kept under a dry mineral oil or in a vacuum or inert atmosphere. Ordinary rubidium is sufficiently radioactive to expose a photographic film in about thirty to sixty days. Because rubidium can be easily ionized, it can be considered for use in ion engines for space vehicles, although cesium (above) is somewhat more efficient for this purpose. Rubidium can also be used as a working fluid for vapor turbines, for use in a thermoelectric generator using the "magnetohydrodynamic" principle, as a "getter" in vacuum tubes, and as a photocell component;

and a rubidium compound with silver and iodine has the highest room conductivity of any known ionic crystal, suggesting use as in thin film batteries.

Doug@DouglasDrenkow.com · 5760 Main St., South Gate, CA 90280 · 562-531-6643 · Cell: 310-570-8930