

# Yttrium

# Y

## **General Information**

### **Discovery**

Yttrium was discovered by J. Gadolin in 1794 in Abo, Finland, and named after the Swedish village Yttria from which it was mined.

### **Appearance**

Yttrium is a silvery-white, soft metal which is relatively stable in air due to formation of the oxide film.

### **Source**

Yttrium occurs in nearly all the rare-earth minerals. It is recovered commercially from monazite sand and bastnaezite by reduction with calcium metal.

### **Uses**

The largest use of yttrium is in the form of yttrium (III) oxide, which is used to produce phosphors which give the red colour in colour television tubes. It is also used in the making of microwave filters.

Yttrium is often used as an additive in alloys, and increases the strength of aluminium and magnesium alloys. It is also used as a detoxifier for non-ferrous metals. It has been used as a catalyst in ethylene polymerisation.

Yttrium-90, a radioactive isotope, has a dramatic medical use in needles which have replaced the surgeon's knife in killing pain-transmitting nerves in the spinal cord.

### **Biological Role**

Yttrium has no known biological properties, and is non-toxic. It is a suspected carcinogen.

### **General Information**

Yttrium reacts with water to give hydrogen. Finely divided metal is unstable in air, and metal turnings ignite in air, in contrast to lump metal which is stable in air.

## Physical Information

Atomic Number	39
Relative Atomic Mass ( $^{12}\text{C}=12.000$ )	88.906
Melting Point/K	1795
Boiling Point/K	3611
Density/kg m <sup>-3</sup>	4469 (293K)
Ground State Electron Configuration	[Kr]4d <sup>1</sup> 5s <sup>2</sup>
Electron Affinity (M-M <sup>-</sup> )/kJ mol <sup>-1</sup>	-39

## Key Isotopes

Nuclide	<sup>88</sup> Y	<sup>89</sup> Y	<sup>90</sup> Y
Atomic mass	87.91	88.91	
Natural abundance	0%	100%	0%
Half-life	106.6 days	stable	64 h

## Ionisation Energies/kJ mol<sup>-1</sup>

M - M <sup>+</sup>	616
M <sup>+</sup> - M <sup>2+</sup>	1181
M <sup>2+</sup> - M <sup>3+</sup>	1980
M <sup>3+</sup> - M <sup>4+</sup>	5963
M <sup>4+</sup> - M <sup>5+</sup>	7430
M <sup>5+</sup> - M <sup>6+</sup>	8970
M <sup>6+</sup> - M <sup>7+</sup>	11200
M <sup>7+</sup> - M <sup>8+</sup>	12400
M <sup>8+</sup> - M <sup>9+</sup>	14137
M <sup>9+</sup> - M <sup>10+</sup>	18400

## Other Information

Enthalpy of Fusion/kJ mol <sup>-1</sup>	17.2
Enthalpy of Vaporisation/kJ mol <sup>-1</sup>	367.4

### Oxidation States

Y<sup>III</sup>

### Covalent Bonds/kJ mol<sup>-1</sup>

Not applicable