Group 12 / IIB; Scandium Group

Basics

The scandium group contains beside yttrium (Y) lanthanium (La) and actinium (Ac) both as individual elements and as place marker for the two groups:

- Lanthanoids (or lanthanides)
- Actinoids
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The lanthanoids together with scandium and yttrium (Y) comprise the **rare earth elements**. These elemet have become rather famous recently (2011) since China has a de-facto monopoly on these elements, When it started raising then prices in the time-honored capitalist way, the world at large suddenly realized how important those elements are for High-Tech applications

Yttrium, for example, is needed for:

- Stabilizing the zirconia used in many sensors or fule cells. In this case you add yttrium oxide (Y_2O_3).
- Producing the red color in fluorescent lights (and now in some LED lights) needed to get white in the end.
- Enabling high-temperature superconductor; e.g in the now famous $YCu_2Ba_3O_7$
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Neodymium, to give another example, is crucial for strong magnets and thus needed in large quantities, e.g. for modern generators.

The actinoids are essentially artificially produced radioactive elements not found in nature.

Table of Basic Data

Name *(German)*	**Scandium** *Scandium*	**Yttrium** *Yttrium*	**Lanthan** *Lanthanum*	**Actinium** *Actinium*
Atomic number	21	39	57	89
Atomic mass [u]	44,95591	88,90585	138,9055	227,0278
Melting point [K]	1812	1796	1193	1320
Melting point [^oC]	1539	1523	920	1047
Melting point [^oF]	2802	2773	1688	1917
Boiling point [K]	3105	3610	3727	3470
Density [g/cm^3]	2,99	4,47	6,16	10,07
Ionization energy [eV]	6,54	6,38	5,577	6,9
Electro-negativitiy	1,2	1,1	1,1	1,0
Atomic radius [pm]	160,6	181	187,7	187,8
Ionic radius [pm]	83	106	122	118
Oxidation numbers	3	3	3	3

Lattice typ **Transformation temp. [^{o}C]**	hp -	hcp -	fcc 350 hcp	?
Lattice constant [Å] **(a or c)**	?	3,66 5,81	3,76 6,06	?
Young's - Modul us [GPa]	?	?	37,5	?
Therm. expansion coefficient α **[$10^{-6}K^{-1}$]**	?	?	5,8	?

- In case of doubt all numbers are for room temperatures
- fcc = face centered cubic; lattice const. = a
  bcc = body centered cubic
  sc = simple cubic
  hp = simple hexagonal
  hcp = hexagonal close packed; lattice constants a and c.
  op = simple orthorhombic, monoclinic, triclinic
  tp = simple tetragonal
  dia = diamond structure
  r = trigonal or rhomboedral trigonal