81.12 - Beryllium, chromium, germanium, vanadium, gallium, hafnium, indium, niobium (colombium), rhenium and thallium, and articles of these metals, including waste and scrap.

- Beryllium :

8112.12 - - Unwrought; powders

8112.13 - - Waste and scrap

8112.19 - - Other

- Chromium :

8112.21 - - Unwrought; powders

8112.22 - - Waste and scrap

8112.29 - - Other

- Thallium :

8112.51 - - Unwrought; powders

8112.52 - - Waste and scrap

8112.59 - - Other

- Other :

8112.92 - - Unwrought; waste and scrap; powders

8112.99 - - Other

(A) BERYLLIUM

Beryllium is obtained almost exclusively from beryl, a double silicate of beryllium and aluminium, which is classified under **heading 26.17 except** when it is in the form of a precious stone (e.g., emerald) (**Chapter 71**).

The main commercial methods of extracting this metal are :

(1) **High temperature electrolysis** of a mixture of beryllium oxyfluoride (manufactured from the ore) and barium or other fluorides. A graphite crucible is used as anode and the metal is collected on a water-cooled iron cathode.

(2) **Reduction of beryllium fluoride** using magnesium.

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Beryllium is a steel-grey metal, very light and hard but extremely brittle. It can only be rolled or drawn under very special conditions.

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Unalloyed beryllium is used in the manufacture of windows for X-ray tubes; as components for nuclear reactors; in the aircraft and space industry; in the armament industry; as targets for cyclotrons; in electrodes for neon signs, etc.; as a de-oxidising agent in metallurgy.

It also serves in the preparation of many alloys, for example with steel (spring-steel, etc.); with copper (e.g., the alloy known as beryllium copper, used for the manufacture of springs, of clock or watch parts, of tools, etc.); and with nickel. These alloys are, however, classified in **Chapter 72, 74** or **75** respectively since they contain only very small proportions of beryllium.

This heading covers beryllium in all its forms, i.e., unwrought metal (in blocks, pellets, cubes, etc.), products (bars, rods, wire, sheets, etc.), and articles. Goods made up into specific identifiable articles such as machinery parts, parts of instruments, etc., are, however, **excluded** (see particularly **Chapters 85** and **90**).

(B) CHROMIUM

Chromium is mainly extracted from chromite (chrome iron ore), which is converted to the sesquioxyde which is then reduced to produce chromium metal.

Chromium is steel-grey when unpolished, but white and shiny when polished. It is very hard and resistant to corrosion, but not very malleable or ductile.

Pure chromium constitutes the coating of various articles of other metals (electrolytic chromium-plating). Its main use (usually as ferro-chrome, see Chapter 72) is in the preparation of stainless steel. Most alloys of the metal (e.g., with nickel or cobalt) are, however, **excluded** from this heading in accordance with Note 5 to Section XV.

Certain chromium base alloys are used in jet engines, protective tubes for electric heating elements, etc.

(C) GERMANIUM

Germanium is extracted from residues of zinc manufacture, from the ore germanite (copper germano-sulphide) and from gasworks' flue dusts.

It is a greyish-white metal with certain special electro-ionic properties which enable it to be used in the manufacture of electronic components (e.g., diodes, transistors, valves). It is also used for alloying with tin, aluminium and gold.

(D) VANADIUM

Vanadium is mainly extracted from the ores patronite or carnotite, usually by reduction of the oxide, or from residues of iron, radium or uranium preparation. As the metal itself has few uses, it is usually produced as ferro-vanadium (Chapter 72) or as copper vanadium master alloy (Chapter 74); these are used in alloying with steel, copper, aluminium, etc.

(E) GALLIUM

Gallium is obtained as a by-product in the extraction of aluminium, zinc, copper and germanium, or from gasworks' flue dusts.

It is a soft, greyish-white metal, melting at about 30 °C and with a high vaporisation point. It thus remains liquid over a large temperature range and is therefore used in place of mercury in thermometers and vapour arc lamps. It is also used in dental alloys and for silvering special mirrors.

(F) HAFNIUM

Hafnium is extracted from the same ores as zirconium (zircon, etc.) and has properties very similar to that metal.

Because of its very high rate of absorption of slow neutrons, it is in particular used for the manufacture of control and monitor rods for nuclear reactors.

(G) INDIUM

Indium is extracted from zinc residues.

It is soft, silvery and resists corrosion.

It is therefore used alone or with zinc, etc., to coat other metals. It is also alloyed with bismuth, lead or tin (alloy used in taking surgical casts), with copper or lead (bearing alloys), and with gold (in jewellery, dental alloys, etc.).

(H) NIOBIUM (COLOMBIUM)

Niobium is obtained from the ores niobite (columbite) and tantalite, which are treated to obtain niobium-potassium fluoride. The metal is then extracted by electrolysis or other methods.

It is a silvery-grey metal used in the manufacture of getters (to remove the last traces of gas in radio valve manufacture).

Niobium and its ferro-alloy (Chapter 72) are also used in the manufacture of steels and other alloys.

(IJ) RHENIUM

Rhenium is obtained as a by-product in the extraction of molybdenum, copper, etc.

It is not much used at present, but its use in plating and as a catalyst has been suggested.

(K) THALLIUM

Thallium is extracted from the residues of the treatment of pyrites and other ores. It is a soft, greyish-white metal resembling lead.

It is alloyed with lead (to raise its melting point, and to increase its strength, resistance to corrosion, etc.) and with silver (to prevent tarnishing).