

## Nickel

**Nickel** (pronounced /ˈnɪkəl/) is a metallic chemical element with the symbol Ni and atomic number 28.



### Characteristics

Nickel is a silvery-white metal that takes on a high polish. It belongs to the transition metals, and is hard and ductile. It occurs most usually in combination with sulfur and iron in pentlandite, with sulfur in millerite, with arsenic in the mineral nickeline, and with arsenic and sulfur in nickel glance.

Similar to the massive forms of chromium, aluminium and titanium, nickel is a very reactive element, but is slow to react in air at normal temperatures and pressures. Due to its permanence in air and its inertness to oxidation, it is used in coins, for plating iron, brass, etc., for chemical apparatus, and in certain alloys, such as German silver.

Nickel is magnetic, and is very often accompanied by cobalt, both being found in meteoric iron. It is chiefly valuable for the alloys it forms, especially many superalloys, and particularly stainless steel. Nickel is also a naturally magnetostrictive material, meaning that in the presence of a magnetic field, the material undergoes a small change in length. In the case of Nickel, this change in length is negative (contraction of the material), which is known as negative magnetostriction.

The most common oxidation state of nickel is +2, though 0, +1, +3 and +4 Ni complexes are observed. It is also thought that a +6 oxidation state may exist, however, results are inconclusive.

The unit cell of nickel is a face centered cube with a lattice parameter of 0.352 nm giving a radius of the atom of 0.125 nm.

Nickel-62 is the most stable nuclide of all the existing elements; it is more stable even than Iron-56.

### Applications

Nickel is used in many industrial and consumer products, including stainless steel, magnets, coinage, and special alloys. It is also used for plating and as a green tint in glass. Nickel is pre-eminently an alloy metal, and its chief use is in the nickel steels and nickel cast irons, of which there are innumerable varieties. It is also widely used for many other alloys, such as nickel brasses and bronzes, and alloys with copper, chromium, aluminium, lead, cobalt, silver, and gold.

Nickel consumption can be summarized as: nickel steels (60%), nickel-copper alloys and nickel silver (14%), malleable nickel, nickel clad, Inconel and other Superalloys (9%), plating (6%), nickel cast irons (3%), heat and electric resistance alloys, such as Nichrome (3%), nickel brasses and bronzes (2%), others (3%).

In the laboratory, nickel is frequently used as a catalyst for hydrogenation, most often using Raney nickel, a finely divided form of the metal.

Nickel has also been often used in coins, or occasionally as a substitute for decorative silver. The American 'nickel' five-cent coin is 75% copper. The Canadian nickel minted at various periods between 1922-81 was 99.9% nickel, and was magnetic.

Nickel(III) oxide is used as the cathode in many rechargeable batteries, including nickel-cadmium, nickel-iron and nickel-metal hydride batteries.