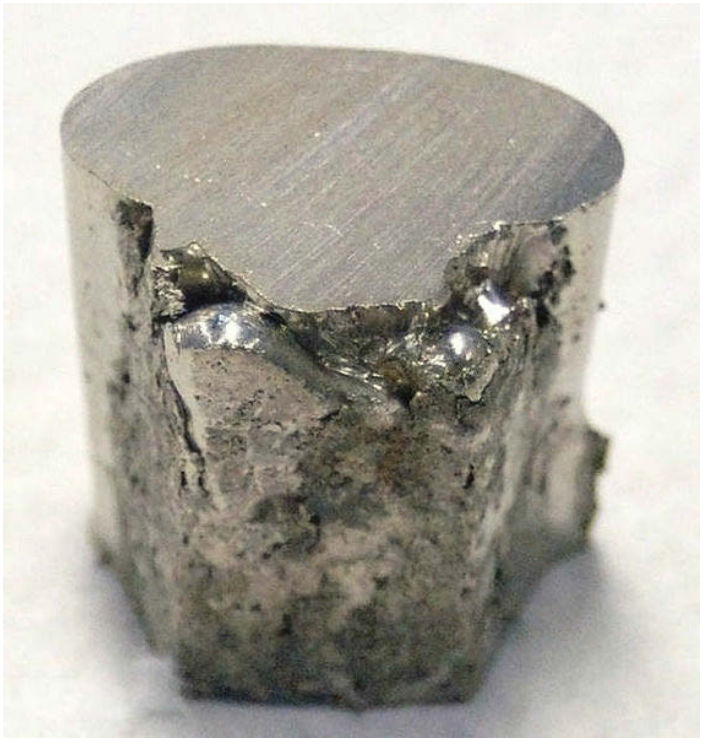
NICKEL – Ni

History

A silvery-white lustrous metal with a slight golden tinge, Nickel is a relatively new metal in humanities long experience of metallurgy. Although innumerable metallic items containing nickel have been discovered from ancient times, the evidence suggest that these were crafted from either ores which natively produced nickel containing alloys or they were made from meteoric iron which commonly contains nickel. Nickel gained its name from German miners in the Ore Mountains who attempted to extract copper from a copper coloured ore 16th century. As the ore was actually a nickel bearing ore, this proved to be impossible using copper extraction techniques. In frustration at the inability to extract copper from the hard won ore, the miners named it *'Kupfernickel'*, which is a derivative of *Krumpfer* – copper and *Nickel* – after the sprite or devil which the miners believed was preventing them from smelting the ore. It was not until 1751 that nickel was extracted from the ore by Swedish chemist Alex Cronstedt, who named the new metal Nickel.

Geology

As a transition element, nickel possesses a combination of ferrous and nonferrous metal properties. It associates with iron (siderophile) and with sulfur (chalcophile). While nickel can be found in a great variety of minerals most commercial mining is focused on two types of ore deposits laterites and magmatic sulphides. The principal ore minerals of laterite deposits are nickeliferous limonite and garnierite, and the principal ore for magmatic sulfide deposits mineral is pentlandite[i].



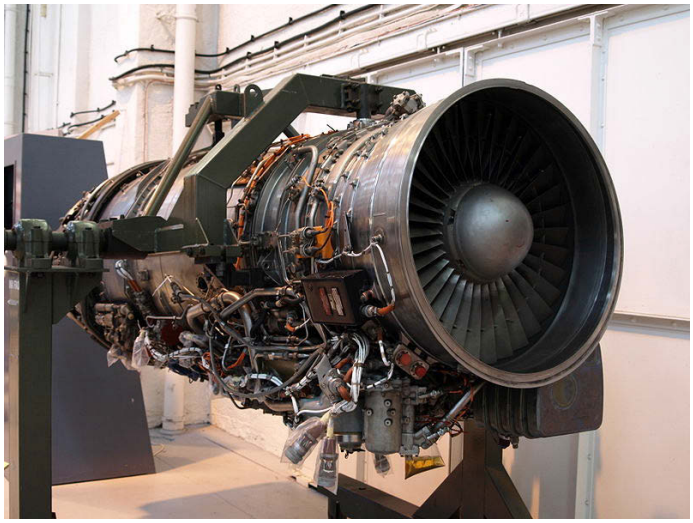
A piece of Nickel about 3 cm in diamiter.
Source: Materialscientist at en.wikipedia

In terms of production, most of the nickel currently mined comes from sulphide deposits. These are easier and cheaper to mine and process with current techniques than lateritic ore deposits. However, extensive mining of sulphide deposits has meant that large scale high grade deposits of this type are being depleted at a faster rate than discovery. As such laterite deposits will account for a greater percentage of nickel production in the future. It is estimated that about three quarters of the world's nickel reserves are in laterite deposits and the remainder in sulphide deposits. Australia has both types of deposits[ii].

Sulphide type nickel deposits are usually, although not always, found hundreds of metres underground resulting in an underground mining operation to extract them. Sulphide ores are much easier to process as they can be concentrated through physical separation by flotation. Laterite deposits are usually located closer to the surface, about 15 to 20m down, meaning they are can be mined via open-cut methods. They form where nickel sulphides have oxidised. The disadvantage of laterites is that it is more difficult to process the ore to retrieve the nickel, requiring the ore to be completely molten or dissolved, dramatically increasing processing costs. As such operations to mine laterite deposits must be of a magnitude larger than sulphide deposits to create the necessary economy of scale for the project to be financially viable.

Victoria

Nickel sulphides have been found at the Thomson River copper mine, and GeoScience Victoria has identified potential for nickel discoveries in western Victoria. Despite this, there are no projects currently underway to locate or develop any potential nickel bearing ore bodies in Victoria[iii].



Nickel is used extensively in the Rolls Royce Turbo-union RB.199 turbofan engine which powers the Tornado jet aircraft flown by Britain's Royal Air Force.
Source: Wikimedia Commons.

Use

For the first century that Nickel was known of, its use was mainly confined to applications which could make use of its appearance, such as cutlery or other decorative purposes. This was to change dramatically in 1889, when nickel's role was revolutionised. At a presentation to the Iron and Steel Institute of Great Britain, James Riley unveiled research which showed that the strength of steel was increased dramatically when alloyed with nickel[iv]. From this point on, nickel emerged as an incredibly important metal in creating superalloys for use in high performance and strength critical applications including aerospace and defence, industrial turbines, geothermal power stations, and petrochemical industries[v].

[i] U.S. Geological Survey, Minerals Information, Nickel Statistics and Information http://minerals.usgs.gov/minerals/pubs/commodity/nickel/
[ii] Mirabela Nickel, Nickel - Sulphide and Laterite, http://www.mirabela.com.au/nickel.asp
[iii] Victorian Department of Primary Industries (2012), Earth Resources, Nickel http://www.dpi.vic.gov.au/earth-resources/minerals/metals/nickel
[iv] Australian Atlas of Mineral Resources, Mines, and Processing Centres - the Australian Mines Atlas http://www.australianminesatlas.gov.au/education/rock_files/nickel.html#source
[v] U.S. Geological Survey, 2010 Minerals Yearbook, Nickel http://minerals.usgs.gov/minerals/pubs/commodity/nickel/myb1-2010-nicke.pdf