

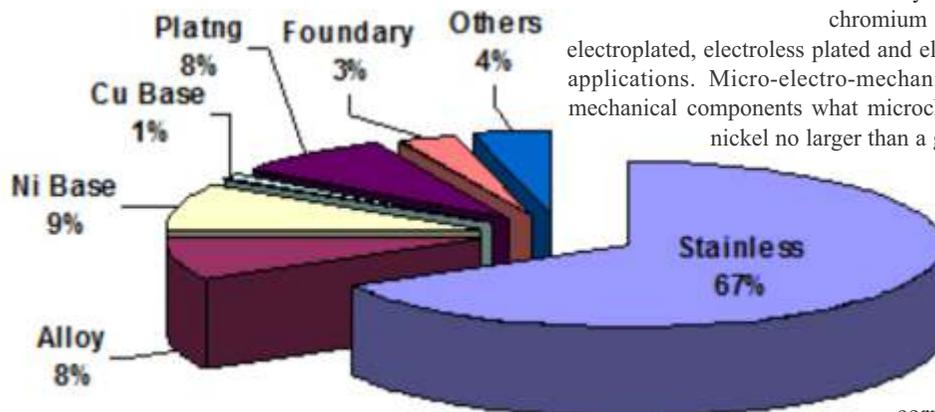
# Nickel - A Metal of Great Value

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**NICKEL IN VARIOUS FORMS**

(Photo Courtesy : Nickel Institute)



Nickel generally goes unnoticed because only about 10% of primary nickel production is used in the elemental form, i.e., as metallic nickel. If coatings are excluded from this, only 1% of nickel is used in SOLID elemental form. Even in plating, common people do see the glitter of chrome, but do not realize that nearly ten times the quantity is the underlying nickel plate. Over two-thirds of primary nickel goes in for making stainless steels; other alloys including alloy steels, nickel alloys, copper alloys and foundry alloys. This distribution of nickel first use is represented in the figure below.

Some of the existing and newly emerging applications of nickel and nickel-containing alloys have been summarized below.

## Catalyst

Nickel's role as a catalyst in chemical process is perhaps the least known of its uses.

Nickel-based catalysts are key to several important reactions, including the hydrogenation of vegetable oils, reforming of hydrocarbons and production of fertilizers, pesticides and fungicides.

## Plating

At the other end of the spectrum, nickel electroplating is extremely well known and widely applied as a substrate for chromium plating, and engineering plating. Nickel can be electroplated, electroless plated and electroformed. This gives rise to infinite number of applications. Micro-electro-mechanical systems (MEMs) are expected to do for mechanical components what microchips did for electronics. 3-dimensional trusses in nickel no larger than a grain of sand are produced by micro-deposition of nickel. This technology is on the way to commercial exploitation in miniature devices for pressure transducers that provide precise measurements for medical monitoring to sensors designed to activate airbags in cars.

## Stainless Steels

Over two-thirds of all nickel produced goes into stainless steel. The combination of corrosion resistance, cleanability, ease of fabrication, appearance and availability means these steels are the materials of choice for many hygienic applications in food processing, beverage production and the medical field.

Today we see nickel containing stainless steel usage has increased exponentially in Architecture, Building and Construction (ABC) sector and Automotive Railways & Transport (ART). Nickel containing Stainless Steels have become the preferred choice of material for Coaches, wagons and other utilities in Indian Railways and we are likely to see good growth considering the expansion plans of Indian Railways in coming years. Application such as stainless steel roofing's, facades, plumbing are likely to emerge in addition to other products for ABC sector.

Process industry, which historically has been consistent consumer of nickel containing Stainless steel in wide ranging process industries including



Refineries, Petrochemical, Chemicals, Dairy, Power, Textile, Sugar, Food processing, Distilleries, Fertilizer, Cement, Drugs, Paper and pulp and others, has adopted stainless steel for many of its applications where maintenance on account of failure of material has been the big concern. Here also many new grades of nickel containing stainless steels with improved mechanical and corrosion properties have replaced conventional materials.

**Heat & Creep Resistant Applications**

The combination of a high melting point, a face-centered cubic (FCC) structure, an adherent oxide film and good alloying ability has allowed nickel to form the basis of a wide range of heat- and creep-resistant alloys that are essential materials in the chemical and aerospace industries. For many years 80%Ni - 20%Cr alloys have been used as heating elements. Addition of other alloying elements and oxide dispersions improve the properties leading to use of nickel alloys for ethylene reformer tubes or for gas turbine blades that make air travel cheap, and for electricity generation.

**Low-expansion Alloys and Magnetic Property Applications**

Originally used in clock pendulums, iron-nickel alloys are widely used in lead-frames in packaging electronic chips and shadow-masks in colour television tubes. Fe-36% Ni alloy is extensively used for storage and transportation tanks for the growing liquefied natural gas industry. The soft magnetic properties of nickel and its alloys are employed in electronic devices and for electromagnetic shielding of computers and communication equipment.

**Copper-Nickel Alloys**

These have a long history of use for coinage and for combating corrosion in marine environments. Typical applications include large desalination plants, which provide the water essential to developments in arid parts of the world.

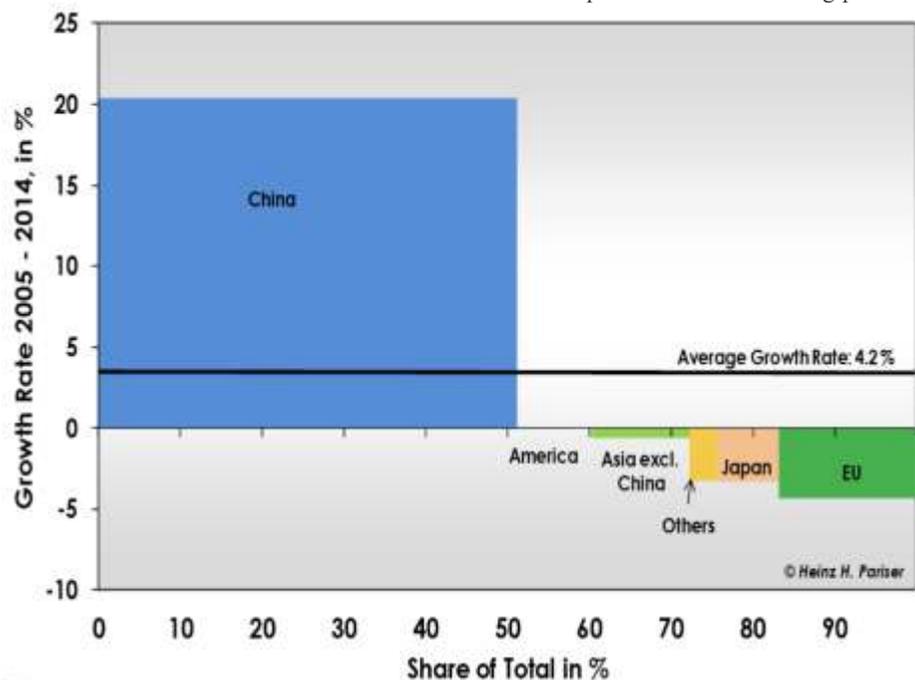
**Portable Power**

Nickel-cadmium rechargeable batteries containing nickel plates and nickel hydroxide have been in use for several years. Now, nickel metal-hydride batteries employing some nickel rare-earth alloys to absorb large amounts of hydrogen are in use. These high-performance rechargeable batteries have led to improved performance from cordless power tools, portable computers and mobile electronic equipment. These hydrogen storage alloys are finding applications in the gasoline-electric hybrid cars. The nickel metal hydride

batteries are recharged by regenerative braking during normal driving.

**Nickel Consumption - Past and Present Scenario**

As stated above nickel consumption is primarily dominated by the stainless steel sector. Over a decade, the global nickel market has witnessed strong growth in production as well as consumption patterns. Although consumption levels increased across the world, China exhibited one of the largest growth rates. China alone accounts for more than 50% of the total melt production of stainless steel in the world therefore making it the world's largest consumer of nickel. If we look at the below graph we can see the phenomenal growth of nickel end use in China over a decade which is largely attributed to stainless steel growth.



However, in 2015, as the global demand weakened and commodity prices fell, we saw a challenging environment in the metals and mining industry. Over last few months we have seen a sharp decline in demand, especially from Chinese, and absence of anticipated shortage as expected after the Indonesian ban in January 2014. Indonesia supplied much of China's ore needs for the production of nickel pig iron until the country banned exports in January 2014 to encourage domestic processing.

Since then Nickel has fallen 32 per cent in value at Shanghai exchange and became the worst performing metal on the London Metal Exchange this year, plunging 41 percent. It is the biggest annual decline since the global

financial crisis and the lowest since August 2003.

As a result of plummeting prices Nickel smelters in China may be forced to shut down or drastically slash their output which can result in tighter supplies for 2016.

Also the optimistic growth in India, in their stainless steel production, can give a push to the nickel consumption in near future.

**Nickel Supports Sustainable Growth**

First, nickel prices are the highest of the common non-ferrous metals. This means that there is serious commercial motivation for using it efficiently and reducing wastage. Similar are the incentives for recovering and recycling nickel at all stages of fabrication and use cycle. Second, most applications of nickel are based upon the nickel-containing product

having resistance to corrosion in use. This means that at end-of-life, most nickel-containing articles are still intact and easily identifiable. This greatly facilitates recycling.



Nickel has all its sterling properties, each of which, alone or in various combinations, is so critical to our high-tech lifestyles that it is quite imperative that in future also nickel will continue finding its way into hundreds of thousands of individual applications.