STRATEGIC BUSINESS PLAN
ISO/TC 155

EXECUTIVE SUMMARY

This document gives background and strategic information related to the world-wide nickel industry along with detailed information on the related ISO activities and standards published.

Nickel is mined, smelted and refined in a number of locations around the world. However, the primary nickel producers number is around 50. Nickel continues to be a growth industry with demand increasing at about 4.5% per year on average for the last 10 years, spurred by the significant economic expansion in China.

ISO/TC 155 was formed in 1973 and held its first plenary meeting in Ottawa in 1974. The primary interest at that time was the development of standards for refined nickel with corresponding interest in the analysis of refined nickel under a sub-committee ISO/TC 155/SC3 (disbanded in 2011). Over the years, TC 155's work in developing, reviewing and updating standards has progressed through a main committee dealing with specifications and terminology for refined nickel and various sub-committees dealing with specifications for nickel alloys and for ferronickel, and with analytical procedures for refined nickel, ferronickel and nickel alloys.

Since its inception, the Secretariat of the committee has been held by SCC (Canada), and is now held by AFNOR (France) since 2010.

1. INTRODUCTION

1.1 ISO technical committees and business planning

The extension of formal business planning to ISO Technical Committees (ISO/TCs) is an important measure which forms part of a major review of business. The aim is to align the ISO work programme with expressed business environment needs and trends and to allow ISO/TCs to prioritize among different projects, to identify the benefits expected from the availability of International Standards, and to ensure adequate resources for projects throughout their development.

1.2 International standardization and the role of ISO

The foremost aim of international standardization is to facilitate the exchange of goods and services through the elimination of technical barriers to trade.

Three bodies are responsible for the planning, development and adoption of International Standards: ISO (International Organization for Standardization) is responsible for all sectors excluding Electrotechnical, which is the responsibility of IEC (International Electrotechnical Committee), and most of the Telecommunications Technologies, which are largely the responsibility of ITU (International Telecommunication Union).

ISO is a legal association, the members of which are the National Standards Bodies (NSBs) of some 164 countries (organizations representing social and economic interests at the international level), supported by a Central Secretariat based in Geneva, Switzerland.

The principal deliverable of ISO is the International Standard.

An International Standard embodies the essential principles of global openness and transparency, consensus and technical coherence. These are safeguarded through its development in an ISO Technical Committee (ISO/TC), representative of all interested parties, supported by a public comment phase (the ISO Technical Enquiry). ISO and its Technical Committees are also able to offer the ISO Technical Specification (ISO/TS), the ISO Public Available Specification (ISO/PAS) and the ISO Technical Report (ISO/TR) as solutions to market needs. These ISO products represent lower levels of consensus and have therefore not the same status as an International Standard.

ISO offers also the International Workshop Agreement (IWA) as a deliverable which aims to bridge the gap between the activities of consortia and the formal process of standardization represented by ISO and its national members. An important distinction is that the IWA is developed by ISO workshops and fora, comprising only participants with direct interest, and so it is not accorded the status of an International Standard.

2. BUSINESS ENVIRONMENT OF THE ISO/TC 155

2.1 Description of the Business Environment

The following political, economic, technical, regulatory, legal and social dynamics describe the business environment of the industry sector, products, materials, disciplines or practices related to the scope of this ISO/TC, and they may significantly influence how the relevant standards development processes are conducted and the content of the resulting standards:

Nickel, by itself or with other metals and materials, has made, and is making, far-reaching contributions to many of mankind's endeavors. The metal plays a key role in industries as diverse as transportation, architecture, food processing, water purification, chemical and petrochemical refining and production and healthcare.

2.1.1 Scope of ISO/TC 155

The **scope of ISO/TC 155** is: "Standardization in the field of nickel, ferronickel and nickel alloys including terminology, specifications and methods of sampling, testing and analysis".

Important factors governing the work programme involve the development of terminology, specifications and methods of sampling, testing and analysis. Since 1974, ISO/TC 155's attention to developing, reviewing and updating standards has progressed through committees dealing with specifications for refined nickel, ferronickel and nickel alloys, and with analytical procedures to support the specifications and meet the needs of industrial laboratories.

2.1.2 Properties of nickel

Nickel is a silvery white metal, ferromagnetic at ordinary temperature. It is insoluble in water but dissolves readily in dilute nitric acid. Finely divided nickel powder absorbs up to seventeen times its volume of hydrogen and thus has great catalytic power.
Nickel has a unique group of properties related to corrosion resistance, strength, toughness, catalysis and magnetism. Its use is therefore versatile, advantageous, and in some cases essential, for many thousands of industrial, commercial and retail applications.

2.1.3 Nickel sources

Two very different processes result in two types of nickel ore, sulfidic and lateritic.
In sulfides, the minerals are concentrated in rocks at depths from a few to many thousands of meters. The largest occurrences are in Canada, Russia, Australia and Southern Africa.
In lateritic ores, the nickel is in the form of an oxide or silicate concentrated by a rock weathering process. The largest occurrences are in Southeast Asia, Australia, South America and the Balkans.

Other significant sources include the Dominican Republic and Cuba in the Caribbean, New Caledonia and Indonesia in the Pacific, South Africa, Botswana and Zimbabwe in Africa, Colombia, Brazil and Venezuela in South America, Greece in Europe, and China.

2.1.4 Worldwide production and consumption of nickel

Mostly nickel mining and processing take place directly in the countries where the nickel deposits are found in nature. However, other considerations such as access to reliable energy sources and access to markets also influence where the nickel production takes place. There are about 50 primary nickel producers worldwide.

"Primary nickel" (i.e. recovered from mined ore) that has been "used" in commerce, generally is recycled at some point and is referred to as "secondary nickel" to distinguish it from "new" or "primary" nickel production.

Primary nickel products fall broadly into two main categories referred to as Class I or "Refined nickel", and Class II or "Charge nickel".

Primary nickel products in both Classes are:

Refined nickel, Class I, 99% Ni or more	Charge nickel, Class II, less than 99% Ni
Electrolytic nickel (in all forms)	Ferronickel, FeNi (more than 15%)
Pellets	Nickel Pig Iron, NPI (less than 15%)
Granules	Nickel oxides/oxide sinter,
Briquettes	NOS Utility
Powders/flakes	
Rounds	
Squares	

Some refineries produce various grades of nickel chemicals and salts such as nickel chloride or sulfate.

Most primary refined nickel products, used in plating, aerospace and other applications which require a high purity material, generally have a nickel content well in excess of 99%, while charge nickel products, melted in steel making and foundry operations, contain less than 99% nickel.

At most, only about 10% of primary nickel production is used in its elemental form, i.e. as metallic nickel. The bulk of this is found in a wide range of plated products, and the growing field of batteries. Other uses are relatively small in tonnage, although important in application and value, including chemicals, catalysts, coinage, pigments and powders.

Substantially 90% of all primary nickel is found in more than three thousand specialty steels and alloys. Two-thirds of primary nickel is found in stainless steels alone, twice as much as all other uses combined, and by far the single most important primary use.

First Use and End Use

Only a small amount of nickel is used as a product in its own right. Most often, it is combined with other materials to produce stainless steel and other alloys with distinct performance characteristics. Nickel is also used as a plating material, and to produce special chemical products for batteries and catalysts. These are known as "First Use" applications, the proportions of which are shown in the following figure.

In 2022, primary nickel consumption totalled 2.9 million tons. Overall, the global nickel consumption was about 3.9 million tons, including 71% of consumption is primary nickel and 29% is secondary nickel.

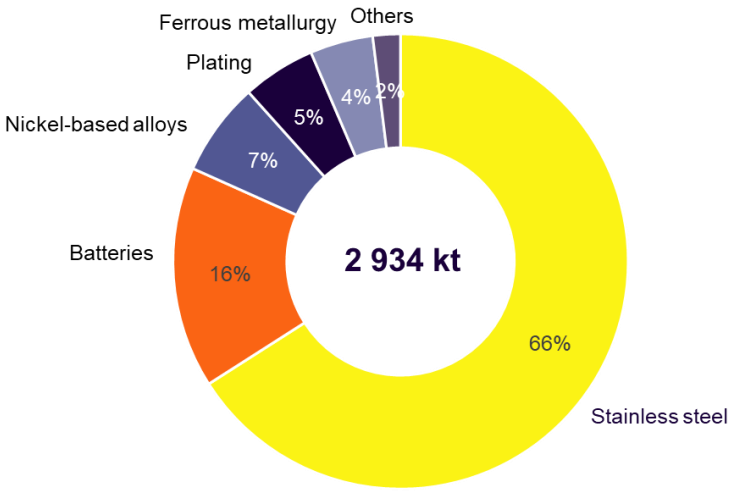

Figure 1: First use applications for primary nickel in 2022

Source: Eramet Market Research

The nickel-containing alloys and chemicals produced during the First Use stage are sold to product manufacturers who use the nickel-containing alloys as part of their manufacturing process. This group comprises a large number of manufacturers of components, sub-assemblies, and other products that are then used in the manufacture of further products. Collectively, they are known as "End Use" applications.

The nine most dominant End Use applications for nickel are:

- Construction,
- Piping (oil, gas & power),
- Transport,
- Healthcare,
- Process engineering,
- Food contact materials,
- Water,
- Pulp and paper,
- Consumer products.

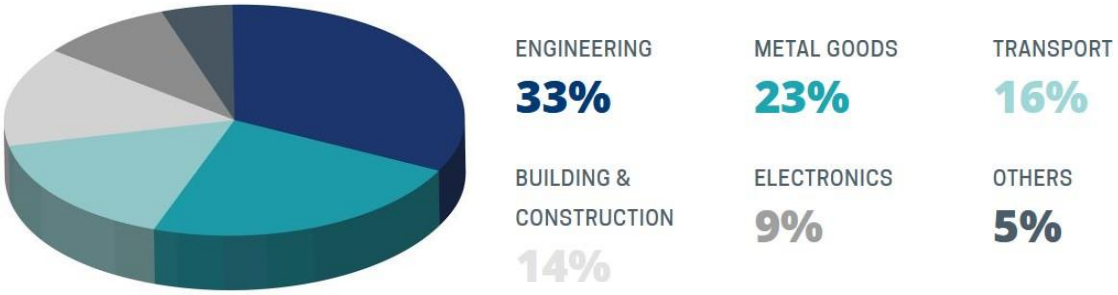

Figure 2: End-use of Nickel

Source: Nickel Institute / Roskill (2021)

2.1.5 Stakeholders

Categories of relevant stakeholders that could be impacted by ISO/TC 155 are as follow:

- manufacturers,
- miners,
- suppliers,
- laboratory and test houses,
- recyclers,
- consumer associations,
- consulting,
- Public authorities, etc.

2.1.6 Environmental health and sustainability challenges

In line with increased worldwide concern about the environment, the nickel industry continues to accept more and more responsibility for the performance of its products from production through manufacturing and use in the marketplace to final recycling or disposal. As sustainable development becomes an even more important factor in today's business environment, nickel producers world-wide are committing significant resources to support the safe production, use and re-use of nickel.

The attributes of nickel - corrosion resistance, high-temperature stability, strength, ductility, toughness, recyclability, as well as catalytic and electro-magnetic properties - are supportive of the needs of sustainability. Thus, nickel in various forms ends up playing hundreds of roles in thousands of products and applications.

At the same time, there are hazards to be managed and environmental impacts to be reduced. Nickel contributes in many ways to the health of people and environments. It is, as well, an essential element for plants, some animals and perhaps for humans. However, it can have toxic effects in certain circumstances and at certain dosages.

2.1.7 Recycling

Around 68% (63% in 2000) of all nickel available from consumer products is recycled and begins a new life cycle (reference year 2010); another 15% enters the carbon steel loop. However, around 17% still ends up in landfill, mainly in metal goods and in waste electrical and electronic equipment.
Recycling is an important factor in nickel's life cycle and an important contributor to global sustainability. Nickel-containing products, such as stainless steel, are durable and are designed for long-term use. Demand for recycled nickel is growing; it is part of the solution as a complement to primary production.
A graphical representation of this global nickel cycle is shown in Figure 3.

Figure 3: Lifecycle of nickel

Source: Nickel Institute (2019)

2.1.8 Battery

Various types of batteries exist and there is a lot of development for batteries technologies containing more nickel and less and less cobalt due to its increasing cost.

2.1.9 Major factors that may have an impact on the development of markets

In any given year, the demand for nickel may rise or fall sharply above the long-term historic trend depending primarily on sharp changes in various sectors of the world economies. Nonetheless, in spite of swings in demand from year to year, over the last twenty years or so, nickel consumption has grown at an average annual rate of about 4.5%. Strength in the long-term, nickel growth trend has been mainly due to exceptional demand for **stainless steel**, the largest single end use for nickel.

2.2 Quantitative Indicators of the Business Environment of primary nickel

The following list of quantitative indicators describes the business environment in order to provide adequate information to support actions of the ISO/TC in term of primary nickel:

2.2.1 World primary Nickel production

According to the INSG (International Nickel Study Group), the production of primary nickel represented 3.06 Mt of nickel in 2022, +17% or +455,000 t as compared to 2021.

Table 1: Top 10 Nickel mining production per country

No.	Country	2022 nickel mine production (in '000 metric tons of contained nickel)
1	Indonesia	1579.0
2	Philippines	360.0
3	Russian Fed.	220.0
4	New Caledonia	200.0
5	Australia	154.9
6	China, P.R.	109.4
7	Canada	96.8
8	Brazil	86.9
9	Guatemala	48.2
10	Colombia	46.4

Source: INSG, May 2023

Table 2: Top 10 Primary nickel production per country

No.	Country	2022 primary nickel production (in '000 metric tons of contained nickel)
1	Indonesia	1,163.3
2	China, P.R.	850
3	Japan	147.5
4	Russian Fed.	143.0
5	Canada	121.2
6	Australia	96.5
7	Norway	81.9
8	New Caledonia	66.2
9	Finland	65.1
10	Brazil	63.4

Source: INSG, May 2023

Table 3: Top 10 Nickel consumption per country

No.	Country	2022 nickel consumption (in '000 metric tons of contained nickel)
1	China, P.R.	1750.0
2	Indonesia	370.0
3	Japan	169.1
4	USA	111.0
5	South Korea	85.0
6	India	69.0
7	Germany	57.0
8	Italy	51.0
9	Taiwan, China	34.5
10	Belgium	30.6

Source: INSG, April 2023

2.2.2 World primary nickel Consumption

According to the INSG, the world nickel consumption was around 2.9 Mt in 2022 corresponding to a 6.3% YoY rise as compared to 2021. This increase was mostly due to the growing battery sector for electric vehicles, as well as a higher nickel consumption in stainless steel despite a declining stainless steel output (higher austenitic ratio combined to a lower scrap ratio).

Stainless steel production decreased by 5.2% year-on-year to 55.3 Mt with a 2.0% decline in Chinese production (source: World Stainless Association).

Batteries sector continues its strong development and accounted for 460,000 t of nickel in 2022 (+41% YoY). This industry should still experience significant growth in 2023.

For other applications, nickel consumption in this market remained quite steady at 540,000 t of nickel.

2.2.3 World nickel market balance

After a deficit in 2021, the nickel market turned out into oversupply of 105,000 t of nickel in 2022.

2.2.4 Focus on Chinese and Indonesian primary nickel consumption and production

The year 2022 was one of the most volatile years for the LME nickel price. With a low of $19,100/t in July and a high of $42,995/t in March, this year was marked by record highs and the disconnection between the LME and 85% of the physical market. This fluctuation was exacerbated by the lack of liquidity in the market.

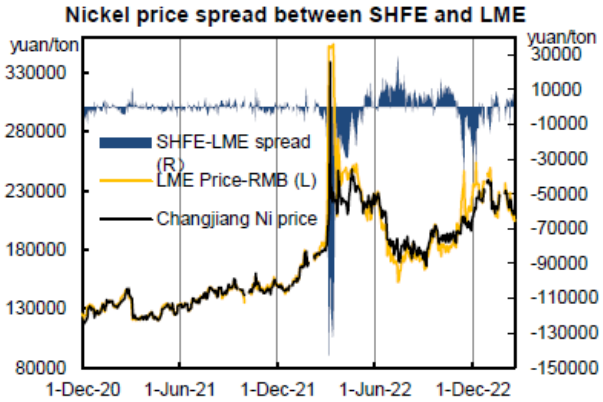

Figure 4: Refined Nickel Price spread between LME and SHFE

Table 4: SHFE/LME monthly Average Price from 2022 to 2023

SHFE & LME monthly average price in 2022-2023

Date	SHFE-Ni yuan/ton	M-o-M%	Y-o-Y%	LME-Ni US$/ton	M-o-M%	Y-o-Y%
2022-Jan	164,126	12.08%	24.19%	22,092	11.15%	23.37%
2022-Feb	174,918	6.58%	27.16%	23,592	6.79%	26.60%
2022-Mar	208,127	18.99%	62.98%	37,790	60.18%	129.84%
2022-April	224,983	8.10%	63.30%	33,298	-11.89%	101.39%
2022-May	206,469	-8.23%	58.96%	27,950	-16.06%	58.61%
2022-Jun	197,756	-4.22%	48.98%	25,838	-7.56%	43.53%
2022-Jul	164,529	-16.80%	14.12%	21,483	-16.86%	14.12%

2022-Aug	172,890	5.08%	20.37%	21998	2.40%	14.91%
2022-Sept	182,041	5.29%	25.06%	22,768	3.50%	17.65%
2022-Oct	183,483	0.79%	23.92%	21,936	-3.65%	13.35%
2022-Nov	197,016	7.38%	34.78%	25,257	15.14%	27.5%
2023-Jan	212631	-2.26%	29.55%	28217	-3.03%	27.72%

Source: Antaike, SHFE, LME

Demand

In 2022, stainless steel production in China reached 31.9 Mt, -2% YoY. It was the first decrease in Chinese stainless steel output since 2015. Indeed, domestic production was very impacted by the effects of the zero-covid policy in China during the year.

Indonesia's stainless steel output reached 4.8 Mt, a 4% decrease comparing to 2021, related to poor end demand and energy shortages.

Nickel demand for batteries mostly came from China (73%) in 2022, where NiSO4 and EV car production has been booming for the last three years. Nickel demand for batteries reached 340 kt Ni during this year in China, representing a major increase of 54%.

Production

According to SMM (Shanghai Metal Market), primary nickel output in China was about 930 kt in 2022, up 30% compared with 715 kt in 2021. Of which, Chinese NPI in 2022 accounted for 44% of the production.

Chinese NPI's output decrease (-19 kt; -5% YoY) is related to the increase in Indonesian NPI output, although this slowed down in 2022 due to energy supply shortages.

Indonesian NPI production increased by almost 30% in 2022 and reached 1,147 kt. More than 65% of this NPI was exported to China.

Another important part of the production in Indonesia is battery-related products. These are intermediates products that will be further processed to NiSO4 (in China), a key element of nickel-based EV batteries. There are two kinds of intermediates produced in Indonesia: MHP and nickel matte. MHP is the result of a hydrometallurgical process named HPAL (High pressure acid leaching) while nickel matte is (in Indonesia) the result of the conversion from NPI (NPI-to-matte route).

In 2022, HPAL production in Indonesia reached 100 kt Ni, a 400% YoY increase, with two producers Lygend (PT Halmahera Lygend) and Huayue Nickel (PT Huaqi). NPI-to-matte production was about 150 kt, an impressive growth from the 5 kt produced in 2021.

In the next years, these kinds of operations will strongly develop in order to meet the demand from batteries. Total added supply from those projects could exceed 1.3 Mt by 2030.

2.2.5 Nickel prices.

Nickel demands and prices are subject to sharp and unexpected peaks and troughs influenced by a variety of factors including sudden changes in the world economies, production shortfalls and inventory fluctuations, speculations by investment funds or changes in stainless steel production cycles.

The availability and price of nickel-containing stainless steel scrap, in particular, can have a significant impact, positive or negative, on demand for primary nickel depending on prevailing economic and market conditions.

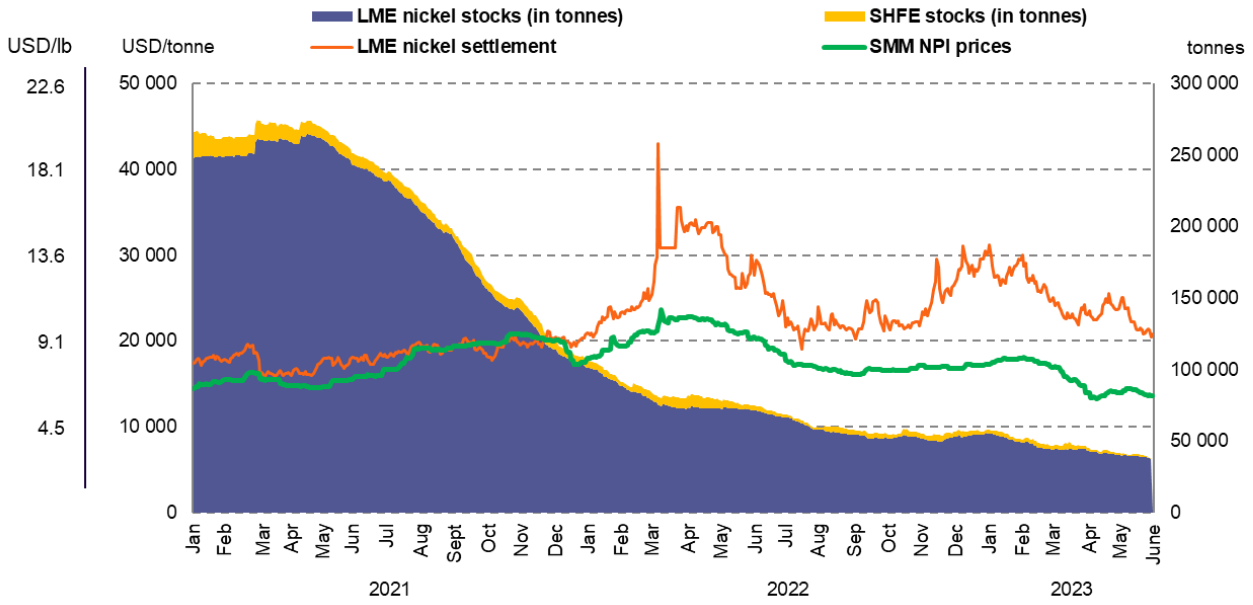

Figure 5: Nickel prices

Sources: LME, Eramet Nickel Market Research

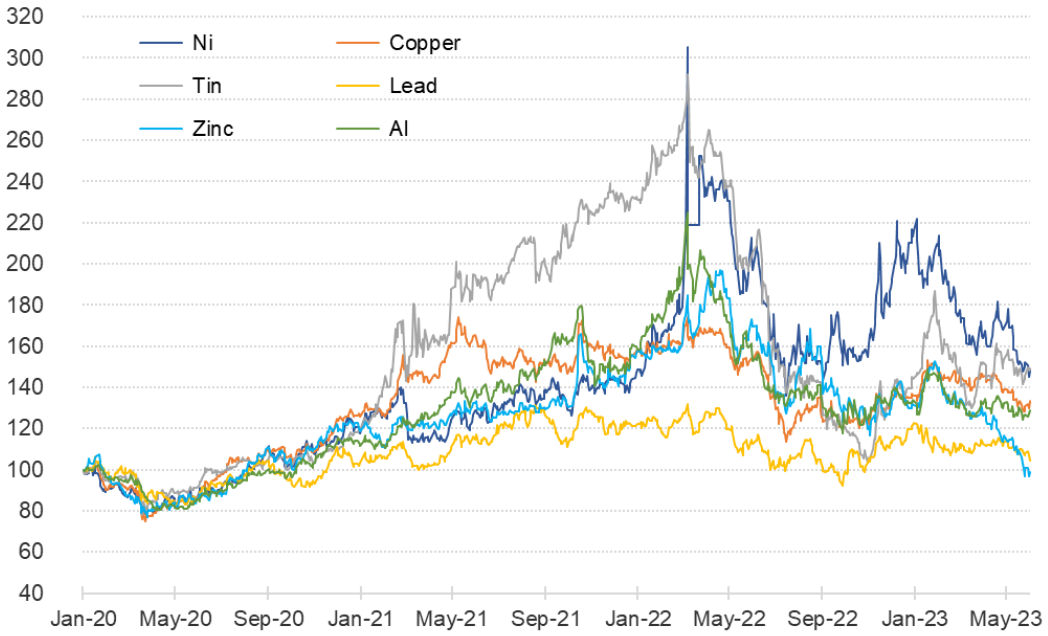

Figure 6: Non-Ferrous Metal prices

Sources: LME, Eramet Nickel Market Research

2.2.6 Main evolution of main industrial nickel consuming sectors

Table 5: First use of primary nickel in 2022

Applications	Percent
Stainless steel	66%
Batteries	16%
Nickel-based alloys	7%
Plating	5%
Ferrous metallurgy	4%
Others	2%

Source: Eramet Nickel Market Research

Trends

In any given year, the demand for nickel may rise or fall sharply above the long-term historic trend depending primarily on sharp changes in various sectors of the world economies. Nonetheless, in spite of wide swings in demand from year to year, over the last twenty years or so, nickel consumption has grown at an average annual rate of about 4.5%. Strength in the long-term, nickel growth trend has been mainly due to exceptional demand for **stainless steel**, the largest single end use for nickel. With the growing consideration of energy transition, the battery sector is however beginning to play a major role in the nickel market.

Stainless steel – market and applications

Stainless steel production and consumption have grown at a rate of some 5% over the last twenty years. A significant development, since 2001 has been the emergence of China, not only as a significant producer of stainless steel, but also as the world's single largest consumer.
Stainless steel has become the driving force behind nickel demand. In the mid 1960's, stainless steel accounted for only 35% of nickel demand; by the mid 1970's, stainless steel was responsible for some 55% of nickel demand.

Since the early 1990's, almost two-thirds of annual nickel demand or consumption can be traced to strong demand for stainless steel and 66% went to stainless in 2022. This share is nonetheless set to fall as the battery sector develops. The nickel demand in stainless steel is anticipated to grow at a CAGR of 1.5% over the next ten years.

Excellent corrosion resistance, durability, cleanability and aesthetic qualities together with ease of recyclability are features that combine to make nickel stainless steels a popular and growing choice for a wide range of industrial and domestic uses worldwide.

Applications in the transport industry (e.g. bus or railcar body panels), in building and architecture (e.g. facades, street furniture, baggage handling facilities) and in domestic products (e.g. kitchen appliances and cookware) are easily identified, large tonnage uses. Less recognized are the many uses in the chemical, petroleum and gas, power and related industries where nickel stainless steels are needed to combat corrosion, high temperatures and pressures and other process operating challenges.

In spite of positive long-term growth, forecasts for stainless steel (+1.5% per year), from time to time, sharp deviations will occur above or below the historic trend. As with nickel, unexpected and sudden changes in the global economies, in the availability of stainless steel scrap or in the building or reduction of inventories by stainless steel traders and consumers will continue to contribute to the volatility in demand for stainless steel and hence the demand for and price of nickel.

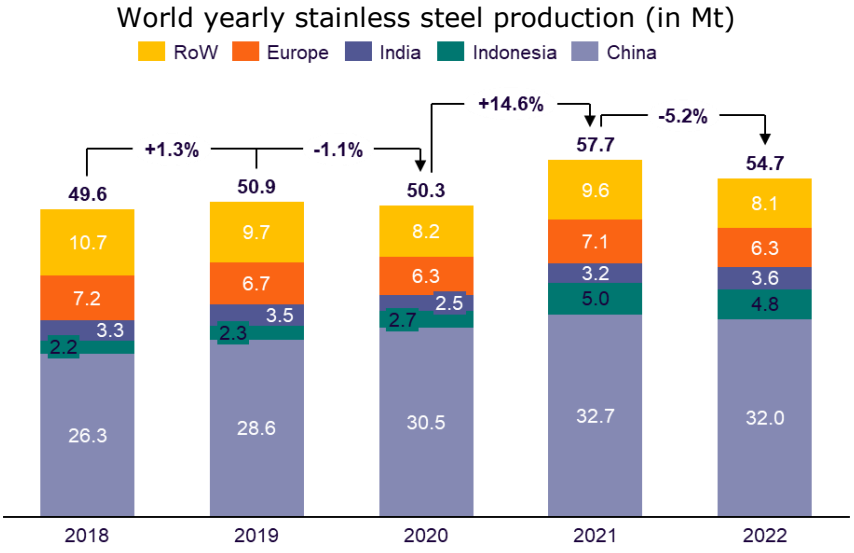

Figure 7: Annual stainless steel production in the world, in million tons

Source: Eramet Nickel Market Research

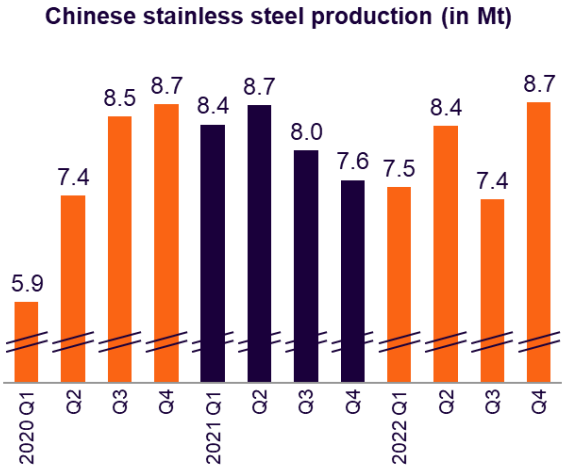

Figure 8: Chinese stainless steel production in the world, in million tons

Source: Eramet Nickel Market Research

The Chinese consumption of nickel for the production of stainless steel represents the major part of the world consumption.

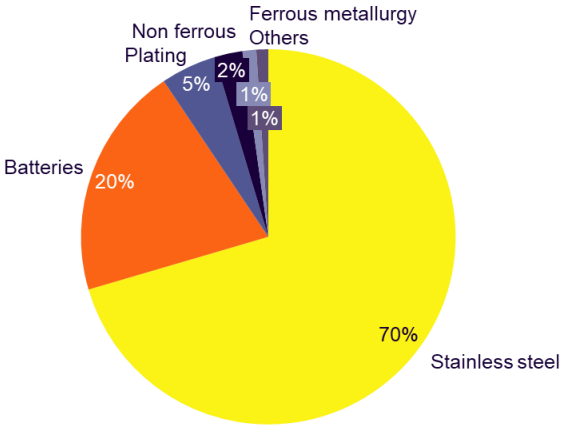

Figure 9: Chinese consumption breakdown in 2022

Source: Eramet Nickel Market Research

In 2022, the consumption of primary nickel in China increased by 13% to 1.69 Mt, with stainless steel sector representing 70% and battery sector rising to 20%.
The growth rate of nickel consumption in stainless steel sector is only 6%, while that of battery sector is 54%.

Nickel-based alloys – Markets and applications
The third largest market segment for nickel is nickel-based alloys, representing around 7% of total nickel consumption. Approximately 195,000 tons of nickel were used in 2022 to produce Ni-based alloys.

Society's need for materials offering greater long-term reliability and safety, together with reduced maintenance, supports growth in the demand for nickel alloys. In general, these alloys, which include the high performance, superalloys used in the aerospace market, extend the use of nickel into a wider range of industrial applications involving more severe environments and hostile conditions that cannot be handled by even the more highly alloyed stainless steels.

Nickel-based superalloys
Nickel-based superalloys, an integral part of the modern jet engine, are also used in aerospace applications such as critical air frame components for supersonic aircraft. Non-aerospace applications for high performance nickel based alloys include wide use in land-based gas turbines, in fossil fuel and nuclear power plants, in the oil, gas and paper industries, and in the corrosive environments typically found in the petrochemical and chemical industries.

Various nickel alloys find applications in products as widespread as heating elements, thermostats, tubing and other down-hole equipment in oil and gas wells, rolls, anchors, fans and other furnace components; and in the shadow masks and lead frames used in the electronics industries.

Nickel – Other markets and uses

Nickel plating is yet another application for nickel. Some 5% of refined production finds its way into the plating industry where usage is growing at about 2% per year. Although nickel plating is used widely throughout industry for wear and corrosion protection, its best-known application is as a base for decorative chromium plating, for example in automobile bumpers and trim.

Other "first-use" markets such as nickel in copper or foundry alloys continue to grow, but at low rates in the order of 1% per year.
Economic growth, environmental protection and the emerging need for longer-lasting, more durable, high temperature and corrosion-resistant materials are factors expected to provide significant requirements for nickel containing materials.

New applications for nickel

The second largest market segment for nickel is now batteries. New battery types and formats continue evolving to suit new applications such as electric vehicles, cell phones, laptop computers, power tools and many others. The rechargeable batteries market evolved a lot during the last 30 years. At first, the sintered NiCd battery technology was developed, then, NiMH batteries were used for hybrid vehicles and now Li-ion batteries are leading the market (especially NMC and NCA types) for electric vehicles.
Over the last five years, the nickel consumption for this new market has been growing fast at around 20% per year and is expected to further expand by more than 15% per year in average.

Factors affecting production and refining of nickel

The following are some factors that affect nickel production:

- Nearly 70% of the land-based nickel resources are contained in laterite deposits while the remaining 30% are in the sulfide deposits.
- Various analyses indicate that an economic project would need at least 40 kt nickel per year capacity requiring 800 kt of recoverable nickel for a mine life of 20 years.
- The mining and upgrading costs for sulfide deposits are significantly higher than for laterite deposits.
- The processing costs for the sulfide concentrates are generally lower than for laterite and the by-product credits are larger.
- The cost of oil has a significant impact on some lateritic operations.
- New technology in exploration, mining and processing has the potential to decrease the capital and operating costs for both sulfide and laterite operations. In exploration and mining, this includes application of telemining and computer technology. In processing, the application of hydrometallurgy and bioleaching continue to hold promise.
- There is excess smelting and refining capacity for sulfide concentrates.
- Underground sulfide mines are capital intensive and also have high operating costs. New sulfide deposits, likely to be exploited, would be near surface deposits with high grade ore and high by-product credits, and/or low mining costs.

Most of the recent expansion in new nickel production capacity has come from the processing of laterite ores.

3. BENEFITS EXPECTED FROM THE WORK OF THE ISO/TC

The major benefits expected from the work of the committee are up to date global standards for the specification of the chemical composition of refined nickel, the chemical and physical properties of nickel alloys and methods for sampling and testing the properties.

The standards in the field of nickel and nickel alloys may be roughly classified by categories of standards,
i.e. basic standards, product standards and test methods to support these specifications. Basic standards such as terms and definitions are inevitable for facilitating communication and for avoiding misunderstandings between the parties concerned in commercial transactions.

Test method standards are essential for laboratory accreditation and for resolving disputes. Ideally the standard test methods can be used on a daily or production basis. It may be desirable to have two types of test methods, one for everyday use and one, generally more complex method, to resolve disputes.

4. REPRESENTATION AND PARTICIPATION IN THE ISO/TC

4.1 Membership

Countries/ISO member bodies that are P and O members of the ISO committee

4.2 Analysis of the participation

Countries with major nickel producing facilities, countries with major nickel alloys and stainless steel producing operations or countries who are major consumers of nickel or nickel alloys are not adequately represented in ISO/TC 155. We hope to have even more participation and mobilization of national mirror committees.
All nickel producing companies and users of nickel and nickel alloys can reap major benefits from participation in ISO/TC 155, particularly in the field of sampling and analysis. Standard methods are invaluable in resolving disputes and obtaining laboratory accreditation.
The main contributors are Brazil, Canada, China and France.

5. OBJECTIVES OF THE ISO/TC AND STRATEGIES FOR THEIR ACHIEVEMENT

5.1 Defined objectives of the ISO/TC

ISO/TC 155 was formed in 1973 and held its first plenary meeting in Ottawa in 1974. The primary interest at that time was the development of a standard for refined nickel with corresponding interest in the analysis of refined nickel under SC 3 (disbanded in 2011).

The primary objective in ISO/TC155 is to ensure that ISO standards being developed and/or updated are relevant to the needs of the marketplace and that through direct or indirect assistance; they are used or adopted by national or regional standardization organizations.

Currently, the objectives of TC/155 are the maintenance of published standards and the rebuilding of representation in the main and sub-committees. The greatest need for new standards concerns method analysis, but other standards shall be updated.

5.2 Identified strategies to achieve the ISO/TC's defined objectives

Promotion and development of ISO standards
ISO standards should be used directly or indirectly by adopting them into national or regional standards. The adoption of ISO standards to national or regional standards is influenced by the members participating in the development of the ISO standards. It is therefore necessary to promote participation through contacts at the national level in countries which could or should have a considerable interest due to the mining, refining or use of nickel and nickel alloys.

Nickel and sustainability and environment standards
The nickel industry provides many materials needed to improve the quality of life, wealth and environmental benefits. Nickel is not "consumed" and whatever is taken from the inventory of nature is available for use and reuse.
The attributes of nickel, in steels and alloys, – corrosion protection, durability, ease of cleaning, power storage such as in rechargeable batteries, the ability to act as a catalyst and to be recycled effectively, - contribute to sustainable solutions.
Future needs may be related to the need for the development and standardization of test methods specifically to determine nickel in the environment.

Revision of ISO standards
Revision work now occupies a major important part of ISO/TC 155 and its sub-committee's work. Furthermore, in promoting the ISO standards to be more usable in each country, ongoing revisions and updates will be needed to improve the harmonization level between ISO standards and national or regional standards. Test methods need to be modernized.

Allocation of priorities
Giving priority to the specific work items is important for timely development of standards in response to industry needs. The highest priority must be given to the periodic review of existing standards to ensure their relevancy in meeting the needs of industry. As a general guide, priorities should be considered in the following areas:

Basic and test method standards
Test methods
Sampling

Product standards
Material specifications for refined nickel
Material specifications for ferronickel
Material specifications for nickel alloys
Material specifications for which future demands are expected
Items that have received a high level of support from P-members

Particular developments are expected for specific topics such as:
Determination of nickel and cobalt content in nickel alloys by ICP method

Determination of zirconium content in nickel alloys
Determination of refractory elements
Determination of nickel in ferronickel
Determination of cobalt in ferronickel
Application of Xray fluorescence spectrometry for the analysis of Nickel alloys
Review of existing specifications for FeNi, and need for new specifications for Nickel alloys

Progress control
Target time scales for working drafts, committee drafts and draft International standards are clearly stated in the ISO/IEC Directives.

Effective use of preliminary stage prior to new work item proposals
The preliminary stage has been adopted in the ISO/IEC Directives, taking account of preliminary work items that are not yet sufficiently mature for processing to further stages. This preliminary stage should be used to prepare documentation and plans for new work items. A proposal for a new work item should be accompanied by detailed documentation of requirements. Working drafts should be prepared in machine - readable form using the ISO template at the earliest stage.

Re-Engineering of technical committee structure
The structure of ISO/TC 155 and its subcommittees must be a living structure which should be adapted to the needs. Any proposed evolution will be to develop a better efficiency of the mobilized expertise, (which is a rare resource from the industry) and a better response to the industry needs.

The effective participation of a sufficient number of countries in ISO/TC 155 and its WGs' work will be looked at. One way of involving more countries in the TC, and in order to increase the involvement of developing countries, would be to appoint co-conveners.

To understand the needs of users and to avoid duplication or contradiction with other works, ISO/TC 155 would need to reinforce its network, setting up liaisons with other international organizations, should they be standards/references developers, institutional, professional, or research organizations.

6. FACTORS AFFECTING COMPLETION AND IMPLEMENTATION OF THE ISO/TC WORK PROGRAMME

The reduction in participation by key member bodies is the most serious factor in maintaining the existing international standards, or implementing procedures for revisions, or replacing old, but still valid, test methods with new methods using more modern technology.
This situation has arisen due to escalating costs, the general economic situation and the retirement of a number of key supporters in industry.

Also the major use of nickel is in stainless steel, a material that is covered in the scope of ISO/TC 17. In the area of test methods, inter-laboratory testing of the procedure is required to obtain data for statistical evaluation of the performance of the method. Downsizing of industrial laboratories has seriously limited the resources available. The testing laboratories need proven methods for the validation of their own in-house techniques, but do not appear to be receiving the required management support.

The technical committees are dependent on experts from industry for their continuing support. There appears to be ever increasing internal pressures on these experts by their own organizations. It also appears that many national standards organizations may not be reaching out to industry to ensure that the key people are aware of activity in international standardization.

The development of an International Standard in analytical chemistry frequently requires that a standardization experiment is conducted prior to the international precision experiment according to ISO 5725. This requires significant extra time.
Within the nickel and nickel alloy industries, complex problems often arise that require a cooperative research effort to bring the technology to a state where it can progress to an International Standard. This must be recognized in time scales.

Nickel is a highly specialized industry sector with relatively few participating members. As a result, there is a heavy workload for individual participants.
Since this is such a specialized area, there are very few readily available suitable test samples. Additional time is often required to produce these and assess their suitability.

Proposed actions
Direct contact should continue with key industrial companies to make them aware of the activities of ISO/TC 155 and to encourage a renewal of participation through National Member Bodies.
All Member Bodies (both "P" and "O") are registered with the web site and have been invited to nominate individuals who could also have access to the site.

Since 2011, the structure of ISO/TC 155 has been reviewed and its subcommittees has been disbanded and working groups implemented instead.
This action aims at developing a better efficiency of the mobilized expertise and a better response to the industry needs.
To understand the needs of users and to avoid duplication or contradiction with other works, ISO/TC 155 would need to reinforce its network, setting up liaisons with other international organizations, should they be standards/references developers, institutional, professional, or research organizations.

7. STRUCTURE, CURRENT PROJECTS AND PUBLICATIONS OF THE ISO/TC

Information on ISO online

The link below is to the TC's page on ISO's website:
ISO TC 155 on ISO Online

Click on the tabs and links on this page to find the following information:
- About (Secretariat, Secretary, Chair, Date of creation, Scope, etc.)
- Contact details
- Structure (Subcommittees and working groups)
- Liaisons
- Meetings
- Tools
- Work programme (published standards and standards under development)

Reference information

Glossary of terms and abbreviations used in ISO/TC Business Plans

General information on the principles of ISO's technical work