

NICKEL MAGAZINE

THE MAGAZINE DEVOTED TO NICKEL AND ITS APPLICATIONS

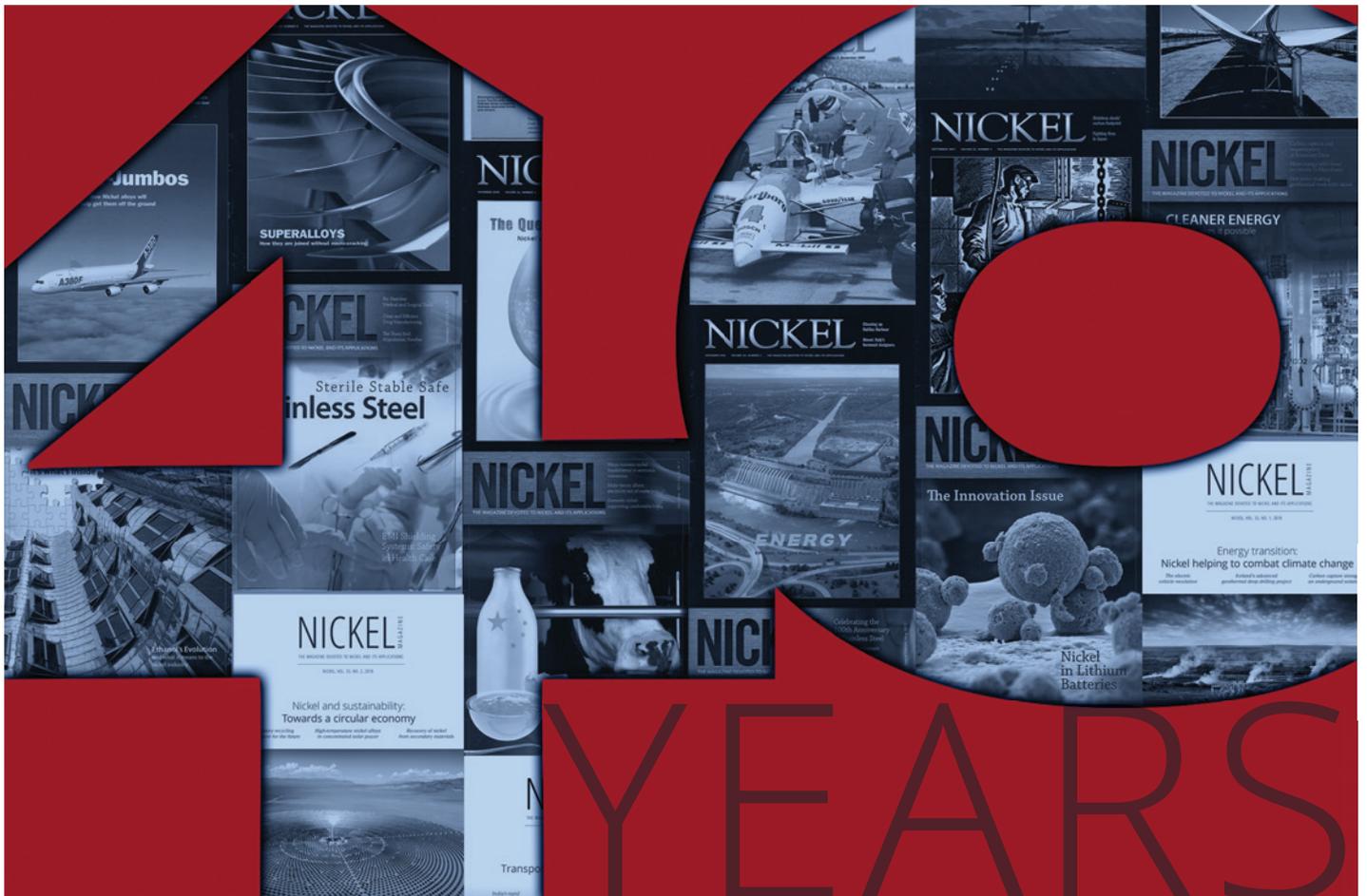
NICKEL, VOL. 40, N° 2, 2025

Forty years of nickel magazine

*Nickel industry changes
over the past forty years*

*Nickel in paediatrics –
teeny-tiny Nitinol stents*

*Forty years of battery
development*





RISK

CASE STUDY 34

RODANTHE BRIDGE, NORTH CAROLINA



NEW RIVER ELECTRICAL CORPORATION

Roughly 2268 tonnes of stainless steel used
Superstructure used 1505 tonnes
Substructure used 694 tonnes
Project awarded in 2017
Cost of the project: \$145 million USD
Lifespan of Jug Handle bridge: 100 years

Located near one of the most significant contiguous seagrass habitats along the eastern United States, the 3.9 km (2.4 mile) Rodanthe 'Jug Handle' Bridge is a testament to innovative construction using pre-cast components and a leapfrog technique of alternating tasks to accelerate construction. Opened in 2022, the new bridge is the second in the state of North Carolina to use nickel-containing stainless steel reinforcing, chosen to help protect against saltwater.

To withstand the saltwater's corrosive effects, stainless steel was a key component in many areas, including rebar reinforcing the cast-in-place concrete on the deck, exposed hardware such as anchor bolts and signage and encasing utility lines in stainless steel hanger systems. Overall, an estimated 2268 tonnes of stainless steel Grade XM-28 (UNS S24100) in sizes #4-#10 were utilised in this project.

The design-build team chose precast concrete for the piles, girders, and deck panels. Cast-in-place concrete was used for the interior and end bent caps, deck, and barriers.

Ultimately, the 107-span structure was comprised of five sections: the south transition, the south curve main bridge, the tangent main bridge, the north curve main bridge and the north transition.

The extraordinary topography presented many design challenges, including accommodating hurricane wind speeds up to 170 km/h (105 mph), a potential vessel collision, storm surges, pervasive erosion, as well as environmental monitoring to preserve protected seagrasses. The result? A resilient structure engineered to endure the challenges posed by nature.



EDITORIAL: NICKEL 40 YEARS ON – FROM STEEL STAPLE TO BATTERY POWERHOUSE

Four decades ago, when Nickel magazine first rolled off the presses, the world for nickel was quite different from today. In 1985, nickel was primarily the unsung hero behind stainless steel's rise – over half of all primary nickel was destined for cutlery, construction, and industrial machinery. Sulfide ores from Canada, the USSR, and Australia fed the world's appetite, and the notion of nickel as a critical player in the energy transition was not yet a thing.

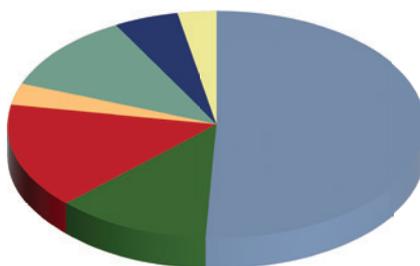
Fast forward to 2025, and nickel's transformation is nothing short of remarkable. Production has increased six fold. Stainless steel still leads, accounting for about 65% of global nickel use, but new sectors have emerged. Today, batteries – a tiny part of the nickel market in 1985 – claim over 15% of demand, with the electric vehicle revolution and energy storage reshaping the nickel narrative.

Geographically, the migration of nickel's heartland is equally striking. Today, Indonesia dominates production. Policy shifts and investment have propelled the country to produce around half the world's primary nickel, a feat unimaginable in 1985.

What remains unchanged is nickel's adaptability. In 1985, it adapted to stainless steel's meteoric ascent; in 2025, it's doing the same for electric mobility and green technologies. The challenges ahead – supply chain shifts, environmental scrutiny, and market volatility – are formidable. But if the last forty years have taught us anything, it's that nickel, ever resilient, will continue to evolve and help shape the future.

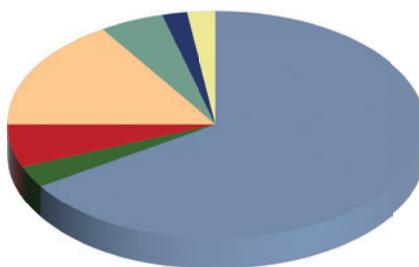
Clare Richardson
Editor, *Nickel*

Nickel first use 1985



- 51% Stainless steel
- 12% Alloy steels
- 15% Nickel-base alloys
- 3% Copper-base alloys
- 11% Plating
- 5% Foundries
- 3% Other

Nickel first use 2024



- 66% Stainless steel
- 3% Alloy steels
- 6% Nickel-base alloys
- 16% Batteries
- 5% Plating
- 2% Foundries
- 2% Other

H. PARSEK

SMR CUMBIH

CONTENTS

- 02 **Case study no. 34**
Rodanthe Bridge, North Carolina
- 03 **Editorial**
Nickel – 40 years on
- 04 **Nickel notables**
- 06 **Nickel industry**
40 years of change
- 09 **Nickel in paediatrics**
Teeny-tiny Nitinol stents
- 10 **Hardfacing**
Nickel extends equipment life
- 12 **40 years of battery innovation**
Nickel's pivotal role
- 14 **Technical Q&A**
- 15 **Why nickel?**
- 15 **UNS details**
- 16 **Sun Life Centre**
Still shining

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NICKEL

NOTABLES



ARTIST'S CONCEPT, CREDIT: SCITECHDAILY.COM

The hype is real

A new type of nickel-based high-entropy alloy (HEA) known as a 'Hyperadaptor' has been developed by a research team at POSTECH (Pohang University of Science and Technology). The innovative alloy maintains both strength and ductility over a wide temperature range, from -196 °C to 600 °C. This breakthrough holds significant promise for applications that involve sudden or extreme temperature changes, including rocket or jet engines, automotive exhaust systems, power plant turbines, and pipelines. It will lead to next-generation materials with consistent mechanical behaviour, greatly enhancing both safety and efficiency in demanding environments. The findings were published in the international journal *Materials Research Letters*.

Full speed ahead

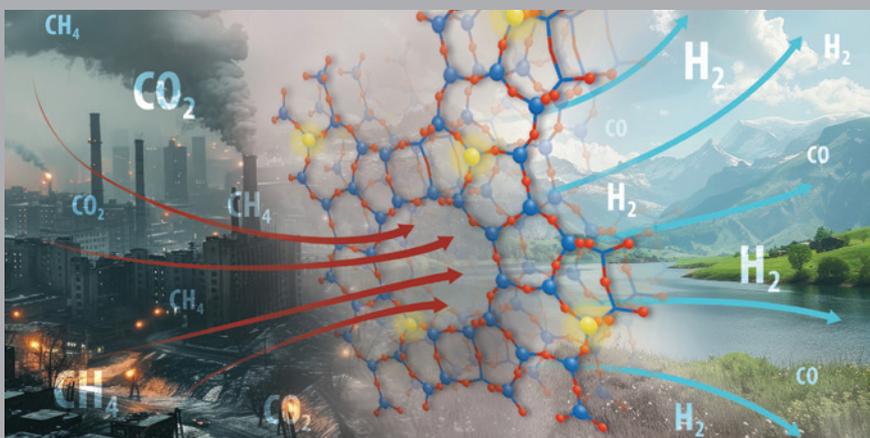


REnishaw

A collaboration between worldwide metal additive manufacturing (AM) machine manufacturer Renishaw and Austrian metal powder provider, Metalpine, has resulted in a proven solution to one of the biggest challenges for metal AM parts in marine applications. To combat the corrosive effect of

salt water, particularly hydraulics, they have optimised the process parameters for CuNi 10 (90% copper, 10% nickel) and CuNi 30 (70% copper, 30% nickel). By leveraging Renishaw's advanced laser melting technology, and refining the energy input parameters, they overcame the material challenges, ensuring high-quality, durable parts and enhanced strength and longevity in harsh marine environments. This will allow naval customers to manufacture their own parts as needed, speeding up the delivery time.

A syngas solution

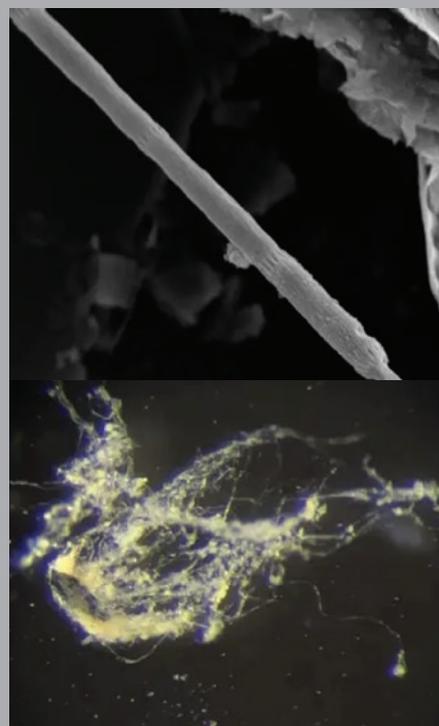


PHILIP GORNY/CORNELL U.S. DEPT OF ENERGY

Researchers at the Department of Energy's Oak Ridge National Laboratory in Tennessee have developed a novel catalyst, a crystalline material called a zeolite that contains silicon, aluminium, oxygen, and nickel. Previous solutions transforming two harmful greenhouse gases, methane (CH_4) and carbon dioxide (CO_2), into valuable components for cleaner fuels and feedstocks were challenged by high temperatures. To synthesise the zeolite catalyst, the researchers removed some atoms of aluminium and replaced them with nickel, effectively creating a strong bond between the nickel and the zeolite host. This makes the catalyst resistant to degradation at high temperatures. The researchers say it's a breakthrough that will speed up syngas production, impacting global energy security, cleaner fuels, and chemical feedstocks. The team has applied for a patent for their invention.

Bacteria buzz

Scientists at Oregon State University have unearthed a new cable bacteria species in a coastal mud flat that acts as electrical wiring. Made of unique, nickel-based molecules that house highly conductive fibres, it stands out in terms of its metabolic potential and distinctive structural features. Named *Electrothrix yaqonensis* in honour of the Native Americans of the region, the bacteria discovery is poised to usher in a new era of bioelectronic devices for use in medicine, industry, food safety, and environmental cleanup. "These bacteria can transfer electrons to clean up pollutants, so they could be used to remove harmful substances from sediments," researcher Cheng Li says. "Also, their design of a highly conductive nickel protein can inspire new bioelectronics." Findings were published in *Applied and Environmental Microbiology*.



OSU

NICKEL INDUSTRY PART 5

FORTY YEARS OF CHANGE

IN THE NICKEL INDUSTRY

Part 5 of the Nickel Industry series of articles looks at technology changes, market growth as well as facility openings and closures. While not comprehensive, it provides a ‘shape curve’ of the industry over past decades.

The nickel industry has undergone major transformation over the past 40 years. Advances in production technology, development of long-known deposits, and growing attention to ESG issues have all reshaped the sector. Environmental performance has improved significantly in many producing countries, driven by regulation, social pressure, and evolving standards.

New resource discoveries

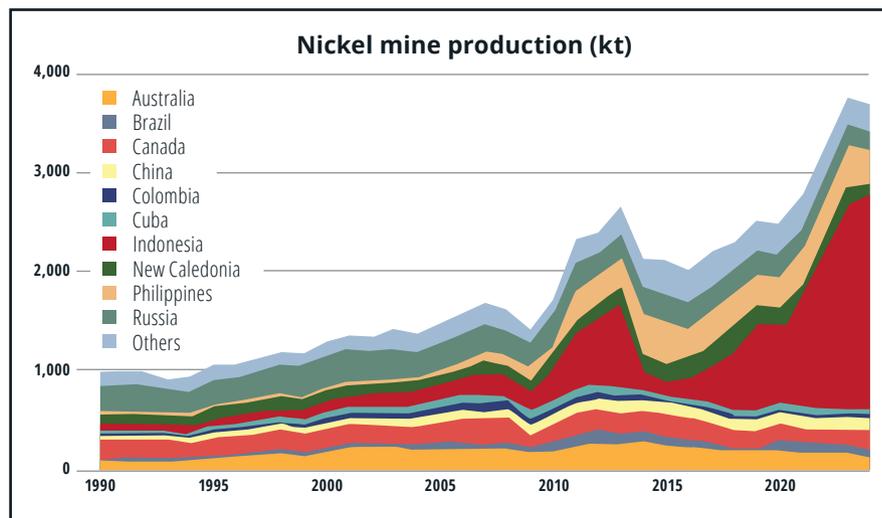
Few major new nickel discoveries have occurred in the past four decades, but significant development of previously known resources has taken place – especially in Asia. On the sulfide side, Voisey’s Bay in Canada is the most notable discovery to reach production during this period.

Laterite deposits, easier to identify due to their surface exposure, have seen widespread development. Many had been known for decades

before recent advances. These include resources in Australia, New Caledonia, the Philippines, Papua New Guinea, and Madagascar. Weda Bay in Indonesia, though discovered in 1996, represents one of the newer large-scale laterite operations.

Indonesia’s rise has defined the last 20 years of nickel production. Since 1990, global mined nickel output has grown at a 4% compound annual rate – outpacing global GDP growth. This expansion has been accompanied by a general decline

Growth of global mined production and top producing countries since 1990



in ore grades, as shown in long-term studies¹, although Canadian sulfide grades have remained relatively stable.

Resource tonnages present a mixed picture. Sulfide deposits have remained broadly stable despite ongoing production, likely due to continued discovery during mining. In contrast, laterite deposits often decline with production, reflecting their more well-defined nature at startup.

Advances in processing

While few processing methods are entirely new, there have been significant developments. One major shift has been the resurgence of high-pressure acid leaching (HPAL) for nickel limonite ores starting in the late 1990s. Though first used in Cuba in 1959, the technology lay dormant for decades. A wave of new Australian HPAL projects began around the turn of the millennium, though only one succeeded long term. Subsequent generations of HPAL plants followed in the Philippines, New Caledonia, Madagascar, Papua New Guinea, Turkey, and more recently, Indonesia – where the technology is now being deployed and expanded with increasing confidence.

Another significant innovation came with the development of chloride-assisted acid pressure leaching for Voisey's Bay sulfide concentrates. While direct leaching of nickel concentrates dates back to the 1950s, Long Harbour marked the first commercial use of chlorides to manage sulfide leaching in acid solutions – a concept known since the 1970s.

The most transformative shift came during the nickel price spike of the mid-2000s: the emergence of lower-grade iron-nickel alloys

like nickel pig iron (NPI, <15% Ni). Initially produced in repurposed blast furnaces in China using imported ore, NPI production expanded rapidly through the use of rotary kiln-electric furnace (RKEF) technology in Indonesia. RKEF, long used to produce ferronickel (FeNi, >15% Ni) from high-grade saprolites, was adapted to treat mid-grade ores (1.6–2% Ni) into alloys suitable for the stainless steel sector.

This growth in NPI output reduced demand for Class 1 nickel in stainless production. However, as demand for battery-grade material increased, some NPI and FeNi producers began converting their output into nickel matte via sulfur addition – a process first used in New Caledonia.

More recently, a new intermediate product, mixed hydroxide precipitate (MHP), has gained traction. Produced via HPAL, MHP has become a preferred feedstock for battery materials, especially in Asia, offering a more cost-effective route than refining pure nickel metal.

Heightened focus on ESG

Over the last 40 years, environmental and social considerations have become central, with stronger regulation and shifting public expectations driving change. Major investments have been made in air and water pollution control, particularly in jurisdictions with stricter environmental laws.

Sulfur dioxide capture and conversion into sulfuric acid has become common at smelters with market access for the byproduct, while others have shut down due to lack of such access. Water treatment and mine site reclamation have also improved across many regions.

The Nickel Institute has played a key role in advancing ESG performance through the development of life cycle assessments (LCAs) over the past two decades. These analyses help producers identify environmental 'hot spots' and data gaps, supporting continuous improvement.

¹ Mudd, G., & Jowitt, S. (2022). *The new century for nickel resources, reserves, and mining: Reassessing the sustainability of the devil's metal*. Society of Economic Geologists.



Voisey's Bay in Canada is the most notable discovery to reach production during this period.

Looking Forward

We have sufficient on-land nickel resources to meet global demand, in both sulfide and laterite forms. While new sulfide discoveries remain possible, they are typically buried and harder to find. AI and machine learning are now being used to enhance exploration capabilities.

Ocean-based resources such as deep-sea nodules and hydrothermal crusts also hold promise, but development is limited by the lack of an internationally agreed regulatory framework.

Processing will continue evolving through adaptation of proven methods from other industries, such as advanced smelting techniques from copper. Pressure oxidative leaching of sulfide concentrates could expand beyond its single current installation. Heap leaching of laterite ores continues to attract interest, with a recent small scale commercial operation in Brazil, expecting to be in full-scale production within the next few years.

Other innovative technologies— such as fine grinding for low-temperature leaching, direct solvent extraction from HPAL leach liquors, and direct current saprolite smelting—have so far not achieved commercial success. Nonetheless, the drive for better economics and ESG outcomes keeps innovation alive.

Nickel production is expected to keep growing, even as the global stock of recyclable nickel in stainless steel, alloys, and batteries increases. Due to the long life of nickel-containing products, a fully circular supply chain remains decades away. However, interest is growing in recovering nickel from legacy waste deposits using techniques like bioleaching, even if these will remain a small part of total supply.

Decarbonisation efforts across the mining sector are influencing nickel operations as well. Renewables and electrified equipment are being deployed where feasible. However, many smelters – especially those off-grid and coal-powered – face substantial barriers to transitioning to low-carbon energy. Hydropower and nuclear remain long-term, capital-intensive options that may be viable in some cases.

Laterite smelters, which rely heavily on carbon-based fuels and reagents, are particularly challenging to decarbonise. Green hydrogen is unlikely to make an impact soon in the regions where most laterite processing occurs.

On the emissions side, more sulfide operations are investing in sulfur capture to reduce pollution, and the momentum toward higher ESG standards continues.

NICKEL IN PAEDIATRICS

TEENY-TINY NITINOL STENTS

It is estimated that globally, 1.3 million babies are born with congenital heart diseases (CHDs) each year. And one in four of those babies will have critical congenital heart disease (CCHD) that requires surgery or other procedures during their first year of life, many within the first few days or weeks after birth.

In the 1990s, paediatric stenting emerged as a minimally invasive alternative to traditional surgeries, providing faster recovery times and fewer complications. However, stenting in children requires special considerations because of their growing bodies and small vessel sizes; the stent must be able to expand as the child grows, either through balloon dilation or by using bioabsorbable materials. One such material suitable for paediatric stenting is Nitinol (UNS N01555), a nickel-titanium alloy (NiTi), known for its unique shape memory and superelastic properties.

Fixing broken hearts

As research progresses, Nitinol remains of key interest for paediatric stenting due to its flexibility and ability to conform to vessel anatomy, especially in twisted or stretched vessels – known as tortuous vessels – while also effectively resisting external compression forces. The latest development of ‘high purity’ Nitinol offers exceptional fatigue resistance, making it suitable for complex anatomies with large bending radii and high operating strains.

A brighter looking future

A San Diego-based medical technology company is developing a Nitinol ductus arteriosus (DA)

stent system and a percutaneous pulmonary flow restrictor (PFR). The ductus arteriosus is a temporary vessel in a fetus that allows oxygenated blood to bypass the lungs in utero. At birth, this vessel closes as the lungs fill with oxygen during the baby’s first breath. Sometimes, the vessel fails to close, and the Nitinol DA stent provides essential blood flow to the lungs or body, replacing open-chest surgery in neonates.

Pulmonary flow restrictors allow device placement via percutaneous catheterisation (through a small incision) to limit blood flow to the lungs. A self-expanding Nitinol frame is essential, as it enables expansion over time to meet changing blood flow needs through balloon-dilation techniques.

When used together, they can treat one of the most morbid CHDs and move a highly risky surgical procedure on a newborn to a minimally invasive approach.

As research advances our understanding of cardiovascular development and intervention strategies, we remain optimistic that Nitinol could be at the heart of the matter.



Nitinol has seen increased demand for use in less invasive medical devices, including stents of various sizes, catheters, and superelastic needles.



Ni

HARDFACING

NICKEL EXTENDS EQUIPMENT LIFE

Nickel-based alloys are increasingly used in hardfacing applications due to their excellent wear and high-temperature resistance.

Hardfacing benefits:

- Increased wear resistance
- Ability to rebuild worn parts
- Improved corrosion resistance
- Extended component lifespan
- Reduced downtime
- Lower maintenance costs
- Enhanced efficiency
- Cost-effective material choice

Metal parts often fail their intended use not because they fracture, but because they wear, which causes them to lose dimension and functionality. Metal parts that move against each other, such as components in an engine or a valve can suffer wear. As will parts of earthmoving and mining equipment and rolls that crush materials ranging from sugar cane to ore at a mine.

To extend the life of such equipment a hard, wear-resistant material can be applied to the surface of a less wear-resistant metal to reduce metal loss due to mechanisms such as galling, abrasion, erosion, impact or corrosion, but typically some combination of these mechanisms. Hardfacing, also known as hardsurfacing, can be performed on a new part to increase its resistance to wear, or it may be used to restore a worn-down surface.

Most hardfacing materials are either iron-, cobalt- and nickel-based. Iron-base constitute the largest volume use producing a broad range of desirable properties at the lowest cost. However, cobalt- and nickel-base alloys can be advantageous where corrosion and high-temperature scaling may have a major effect on the rate of metal loss despite their higher cost.

Century-old invention

The hardfacing process was invented in 1922 and was accomplished using Alloy 6, a cobalt-based alloy. In 1937 the first nickel-based

hardfacing alloy was developed.

Hardfacing of cobalt- and nickel-base alloys can usually be applied by the same welding processes used to weld the underlying base metal and by various thermal spray processes utilising powders or wire of those hardfacing alloys.

Hardness vs. ductility

The microstructure of hardfacing alloys generally consists of hard-phase precipitates such as carbides, borides or inter-metallics bound in a softer iron-, nickel- or cobalt-base alloy matrix. Cobalt-base alloys contain many types of carbides based on chromium, tungsten or molybdenum, while nickel-base alloys can contain borides, carbides and intermetallics based on chromium and silicon.

As is typical with most materials, increasing hardness means decreasing ductility. The main difference between cobalt-base and nickel-base hardfacing is their hardness. Nickel-based coatings are generally harder and perform better under abrasive wear conditions, but they may be



prone to cracking under impact. In contrast, cobalt-base coatings exhibit slightly greater ductility and resistance to impact. Also increasing the volume fraction of the hard precipitate to increase wear resistance reduces the volume fraction of the softer metal matrix also reducing ductility.

Choosing the right option

But just because a coating is harder doesn't mean it's the right one for every wear situation. Cobalt-based coatings are frequently used for valve stems, bushing, piston rods, and similar applications due to their high-temperature wear and corrosion resistance. However, some users may opt for nickel-

based coatings because of their good performance and lower cost.

Nickel-based coatings offer excellent protection in harsh abrasive environments, such as those found in material-handling screw conveyors and other applications such as valve seats, ball valves, and other valve components. Both material families have a wide array of applications across different industries. Neither material family is superior to the other but can be best matched to certain operating environments. Welded and thermal spray nickel-based and cobalt-based coatings offer high wear protection in harsh, abrasive environments. Ni



A common application for hardfacing is earthmoving equipment. Beads of hardfacing are applied in a grid pattern on surfaces that will be exposed to abrasion by dragging through soil.

NOMINAL COMPOSITION OF EXAMPLES OF HARDFACING ALLOYS											
	Name/ UNS	Fe	Ni	Co	C	Cr	W	Mo	Mn	Si	B
Iron-base	Alloy 148	bal	3	-	1.8	30	-	1.5	0.6	1.8	-
Nickel-base	Alloy 60 N99646	4	bal	-	0.7	13	-	-	-	4.3	3
Cobalt-base	Alloy 6 R30006	<3	<3	bal	1.2	28	4.5	<1	<1	<2	-

40 YEARS OF BATTERY INNOVATION

NICKEL'S IMPACT ON THE EVOLUTION OF ELECTRIC VEHICLES

Over the last four decades, battery technologies have profoundly shaped our world, powering everything from early consumer electronics to today's electric vehicles and grid storage systems. In the 1980s, batteries were largely limited to gadgets like the Walkman®, but the landscape changed dramatically in 1991 with the launch of Sony's lithium-ion battery – a revolutionary step that enabled the mobile electronics boom and laid the foundation for electric mobility.

During the 2000s, nickel-metal hydride (NiMH) batteries powered hybrid vehicles like the Toyota Prius. While still used in some hybrids, they were gradually overtaken by lithium-ion chemistries like NMC (nickel-manganese-cobalt oxide) and NCA (nickel-cobalt-aluminum oxide), which offered much higher energy density for plug-in and electric vehicles. By 2020, electric vehicles accounted for about 4.2% of new passenger car sales worldwide. Looking ahead, EV sales are projected to reach 20 million in 2025, or roughly 22% of all new vehicles

– a stunning acceleration and a testament to the advancements in battery chemistry, especially those rich in nickel.

The role of nickel in modern batteries

Today's electric vehicles rely on advanced lithium-ion batteries. But how do elements like nickel, cobalt, and lithium fit into the picture? Nickel and cobalt, often paired with aluminium or manganese, are key ingredients in the battery's cathode. These minerals have transformed EVs, making them more practical for everyday use.

The Mercedes-Benz EQS, a large luxury electric SUV, uses nickel, cobalt and manganese in its battery composition for a longer driving range.



A battery essentially comprises two current collectors, an anode, a cathode, a separator, and an electrolyte. Lithium moves between the cathode and anode during charging and discharging. Using nickel and cobalt in the cathode enhances energy density and stability, directly impacting driving range and battery size.

Tackling range anxiety

Many prospective EV drivers worry about range, but nickel-rich batteries help put those fears to rest. For example, the Hyundai Ioniq 5 uses an 8:1:1 ratio of nickel, cobalt, and manganese, resulting in an impressive range of up to 512 km (318 miles) on a single charge – far surpassing the 160 km range of earlier EVs. Even compact models like the Volvo EX30 can reach 443 km (275 miles) of range, thanks to efficient, high-energy cathodes.

Longevity and reliability

Traditional gasoline vehicles typically last about 214,043 km (133,000 miles). In contrast, EVs using nickel- and cobalt-based batteries are estimated to last around 321,869 km (200,000 miles) – with some fleet studies showing less than 10% capacity loss after 200,000 km (124,274 miles). This means EVs can be driven and recharged over many years without significant decline in battery performance.

Fast charging capability

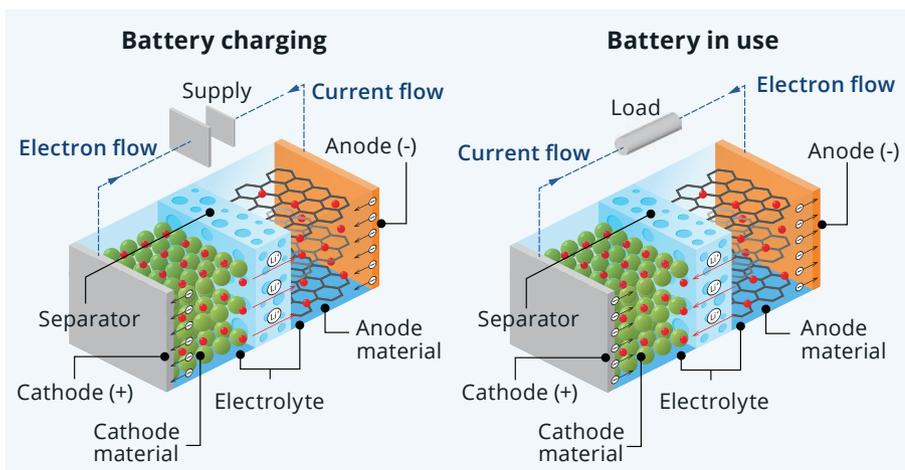
Recent years have seen dramatic improvements in charging speed. Nickel-based batteries tolerate high charging rates, allowing for rapid top-ups. The Mercedes-Benz EQS, for example, can charge from 10% to 80% in about 30 minutes, while the Volvo EX30 accomplishes the same in just 27 minutes. With expanding fast-charger networks, EV ownership is more convenient than ever.

Recyclability and second life

Due to their intrinsic economic value and well-established recycling technologies, nickel- and cobalt-based EV battery chemistries are more feasible and profitable to recycle compared to other chemistries. Several OEMs are working on repurposing, reusing or recycling EV batteries. This extends the usefulness of these minerals and reduces environmental impact.

The road ahead

The evolution of battery technology over the past 40 years has been remarkable, and nickel's role has been central to enabling high-performance, sustainable electric transportation. As we accelerate toward an electrified future, nickel remains a crucial element for energy-dense, reliable batteries, supporting the next era of mobility.



How nickel & cobalt are used in batteries

The anode and cathode materials store the lithium, and charging/discharging occurs when the lithium ions move from cathode to anode, or vice versa. Nickel and cobalt, combined with either aluminium (NCA) or manganese (NMC) or both (NCMA), are often used in the cathode of lithium-ion batteries and provide several benefits that consumers have come to rely on in their EVs.

ASK AN EXPERT – TECHNICAL HELP

FAQ FROM THE NICKEL INSTITUTE

TECHNICAL ADVICE LINE

Geir Moe P.Eng. is the Technical Inquiry Service Coordinator at the Nickel Institute. Along with other material specialists situated around the world, Geir helps end-users and specifiers of nickel-containing materials seeking technical support. The team is on hand to provide technical advice free of charge on a wide range of applications such as stainless steel, nickel alloys and nickel plating to enable nickel to be used with confidence.

<https://inquiries.nickelinstitute.org/>

Q: My customer is requesting that I build a component using Hastelloy®. Are there alternatives?

A: Hastelloy® is the registered trademark for various grades of nickel-base alloys produced by Haynes International. The name is typically restricted to nickel-base alloys produced for corrosion service. And within the Hastelloy family there are major differences in corrosion resistance between the various grades. Each grade usually excelling in a specific application. For example, Hastelloy B-3 is primarily used in reducing environments, particularly those containing strong acids like hydrochloric acid, while Hastelloy C-276 offers a broader range of resistance, including both reducing and oxidising conditions. But, in addition there are other C-Type alloys, C-4, C-22 and C-2000 with slight differences in chemistry that allow them to offer improved corrosion resistance in very specific environments.

The most well-known Hastelloy alloy is C-276 (UNS N10276) (possibly this is the grade you are asking about). There are many producers of this alloy, in Japan, China, Europe and even the U.S.

In most cases the material is produced to the same commercial standards, for example ASTM, ASME, ISO, and EN.

So, if you are simply looking for equivalent material produced to

a commercial standard where the material only needs to conform to an industry grade designation such as UNS N10276 there are alternative sources. Though there can be limitations on availability because these other suppliers might not sell into specific regions or they only produce the alloy in specific product forms or limited thickness or width due to the capability of their processing equipment. Each producer may tweak their production parameters within the limits of the commercial standard – such as annealing temperature or restriction of minor alloying elements – or include a secondary refining process, such as ESR (Electroslag Remelting), in a way they feel optimises the corrosion resistance, thermal stability of the microstructure, or mechanical properties of the alloy. This may be important to specific end-users. Thus, if you are procuring material based on an order from a client that has specifically identified Hastelloy you would need to confirm with your client that these alternatives are acceptable.

This same discussion can be made with respect to Special Metals trademark Inconel® which identifies their family of nickel-base alloys. And again there are equivalent alternatives.

Ni

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Nickel can be found in many forms from nanowires to stainless steel alloys. But what are the properties of nickel that make it an essential element in everyday objects?

Why nickel?

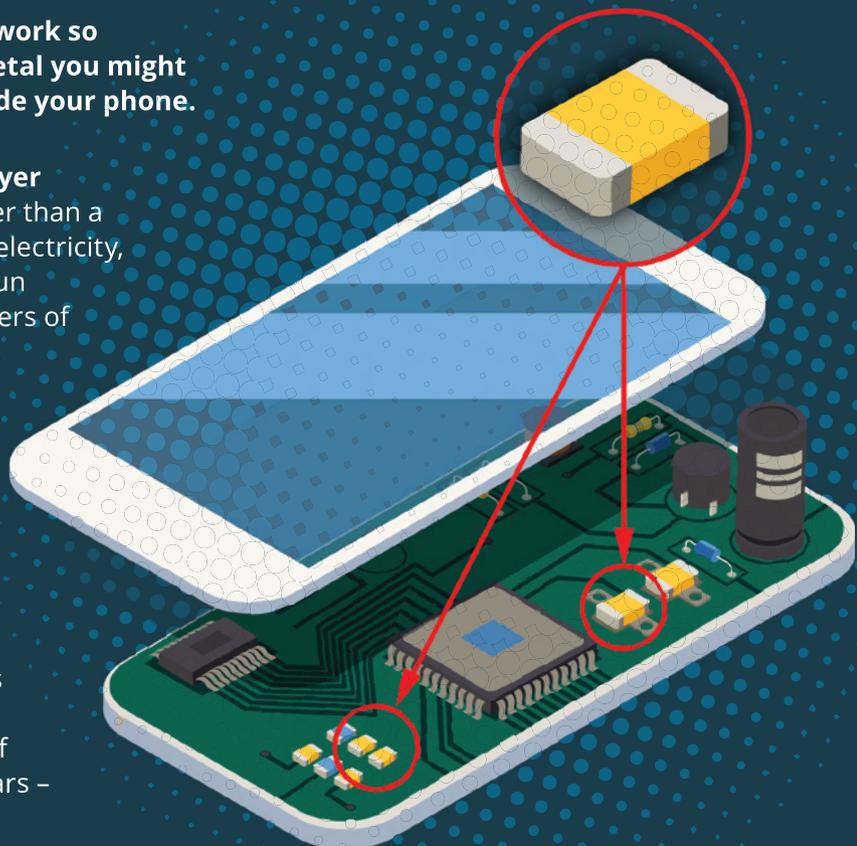
NICKEL IN SMART PHONES

Ever wonder what makes your smartphone work so smoothly? One of the secrets is nickel – a metal you might not think about, but it plays a huge role inside your phone.

Smartphones use tiny parts called **Multi-Layer Ceramic Capacitors (MLCCs)** – some smaller than a grain of sand! These help store and control electricity, so your phone's apps, camera, and games run without problems. Inside each MLCC are layers of metal, and today that metal is mostly nickel.

Nickel replaced older, more expensive metals because it's less expensive, works better, and lets engineers make even smaller and more powerful electronics. Thanks to nickel, your phone can have over a thousand MLCCs, all packed into a tiny space!

In fact, billions of smartphones use tonnes of nickel every year just for these parts. Without nickel, your phone – and tonnes of other electronics like smartwatches and cars – wouldn't be nearly as fast or reliable.



So next time you swipe your screen, remember: nickel's got your back.

UNS DETAILS

Chemical compositions (% by weight) of the alloys and stainless steels mentioned in this issue of *Nickel*.

UNS	C	Co	Cr	Cu	Fe	Mn	N	Nb	Ni	P	S	Si	Ti
S24100 pg 2	0.15 max	-	16.5- 19.0	-	bal	11.0- 14.0	0.20- 0.45	-	0.50- 2.50	0.045 max	0.030 max	1.00 max	-
S30400 pg 16	0.08 max	-	18.0- 20.0	-	bal	2.00 max	-	-	8.0- 10.5	0.045 max	0.030 max	1.00 max	-
N01555 pg 9	0.07 max	0.05 max	0.01 max	0.01 max	0.05 max	-	-	0.05 max	54.0- 57.0	-	-	-	bal



Designed by Webb Zerafa Menkes & Housden Partnership and built by Eastern Construction, the Sun Life Centre's Type 304 stainless steel was provided by Canadian company Atlas Steel.

SUN LIFE CENTRE STILL SHINING

Anchoring a prime corner in Toronto, Ontario's Financial District, the Sun Life Centre shines bright as an example of how stainless steel plays a critical role in durability, aesthetics, and easy maintenance in modern architecture.

Over 40 years since its construction, the building has stood the test of time, earning environmental accolades along the way.

Built in 1984, this striking 28-storey high-rise building is owned by insurance giant Sun Life. It has been subject to moderate pollution levels and de-icing salt. Type 304 (UNS S30400) stainless steel with a bright finish was used in all components, including the curtain wall. While the canopies are glass, Type 304 stainless steel cladding is

part of the canopy framing and column covers. The gleaming exterior is cleaned three to four times a year with neutral detergents and water and a mild abrasive in the spring. In 2010, the Sun Life Centre was awarded LEED Gold certification under the Canada Green Building Council's LEED for Existing Buildings.

All in all, Sun Life chose the right material as insurance for a smart long-term investment.

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