NICKEL MAGAZINE

THE MAGAZINE DEVOTED TO NICKEL AND ITS APPLICATIONS

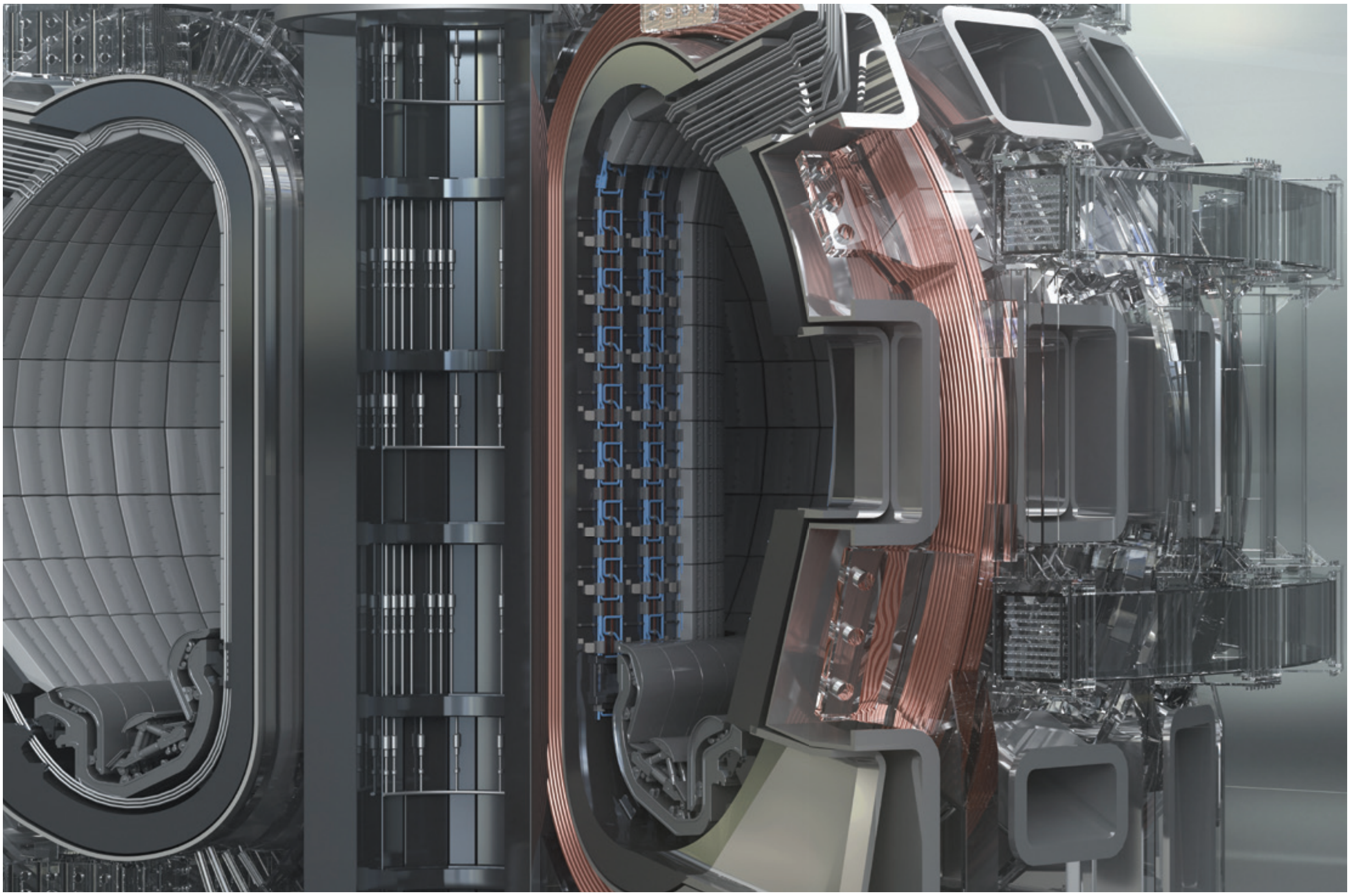
NICKEL, VOL. 40, Nº 3, 2025

Innovative nickel

Inside the stack – at the heart of hydrogen production plants

Built for the extreme nickel's part in fusion innovation

Nickel's innovative role in clad plate technology



CASE STUDY 35
MELBOURNE'S URBAN ARBOURS

BESPOKE WIRE & ROPE AND BROOK JAMES PHOTOGRAPHER.

Type 316 stainless steel was used throughout the project including:

- *~98 lineal metres of 8 mm 1x19 wire rope*
- *~240 lineal metres of 4 mm 7x7 wire*
- *~270 roll swage wire terminations*

Developed by PBBS and backed by the Department of Transport and Planning (Victoria) under the City of Melbourne's Urban Forest Fund.

A visionary pilot project using Urban Arbours *is transforming central tram stops in Melbourne, Australia, by integrating green infrastructure with the long-term advantages of nickel-containing stainless steel.*

Designed as living, breathing structures, the Urban Arbours offer more than just cooler, greener spaces for tram passengers. They support native plants that absorb CO_2, volatile organic compounds (VOCs), and particulate matter, thereby improving air quality.

In collaboration with Yarra Trams, the City of Melbourne, and the Department of Transport, the six new Urban Arbours by Plant Based Building Solutions (PBBS), with design, engineering and installation support by Bespoke Wire & Rope, visually align with existing tram shelters and mark a significant improvement in material performance. Past experiences with corrosion underscored the need for a more durable solution – making stainless steel the clear choice.

The frames were produced by SP McLean Engineering using Type 316 (S31600) stainless steel Circular Hollow Sections (CHS), including 55m of 33.4 x 3.38mm CHS and 85m of 141.3 x 6.55mm CHS.

Over 120 stainless steel anchor and bolt assemblies were used to erect and secure the structure. Arcus Wire Group supplied the vertical trellis cables, Flexi-Mesh canopy, and triangular infills. Type 316 stainless steel was used throughout the project.

These components not only enable plant growth, but also reduce the need for excess structural steel, lowering material use, costs, and on-site fabrication.

This pilot project showcases the durability, longevity, and aesthetic flexibility of stainless steel. Ni

Article courtesy of Australian Stainless Steel Development Association (ASSDA)

EDITORIAL:
INNOVATIVE NICKEL

In an era where innovation is the driving force behind economic growth and societal progress, nickel has emerged as a critical ingredient in the technological advances which are shaping our present and future. In this edition of Nickel, *we illuminate the role of this versatile metal in forward-looking technologies which contribute to the UN Sustainable Development Goals.*

> *"Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation"*
>
> —UN Sustainability Development Goal 9: Industry Innovation and Infrastructure

Nuclear fusion advances and green hydrogen production represent two of the most promising frontiers in the quest for sustainable, low-carbon energy. Combine them and the synergy has huge potential: could fusion reactors one day provide the abundant, carbon-free electricity needed to produce green hydrogen at scale? In turn, could green hydrogen serve as an efficient energy carrier to allow fusion-generated power to be stored and transported? It may be some way off, but together green hydrogen and nuclear fusion could revolutionise global energy systems, supporting decarbonisation and contributing to a more sustainable future. Initiatives like the International Thermonuclear Experimental Reactor (ITER) are directly supporting the aims of the UN Sustainable Development Goals.

Innovation often starts with the periodic table – where nickel can be found front and centre. Its unique properties – corrosion resistance, strength at high temperatures, and formability – make it indispensable to engineers and innovators seeking sustainable solutions. Nickel quietly enables technological breakthroughs – as demonstrated by the 2025 Nobel prize for chemistry – and innovation that will define the next chapter of human progress.

Clare Richardson
Editor, *Nickel*

The JET (Joint European Torus) Tokamak, located in the UK, was the largest magnetic confinement fusion experiment that used a doughnut-shaped device to create and control superheated plasma. It provided crucial data for the next-generation ITER Tokamak project in France before its decommissioning began. *Read more on page 10.*

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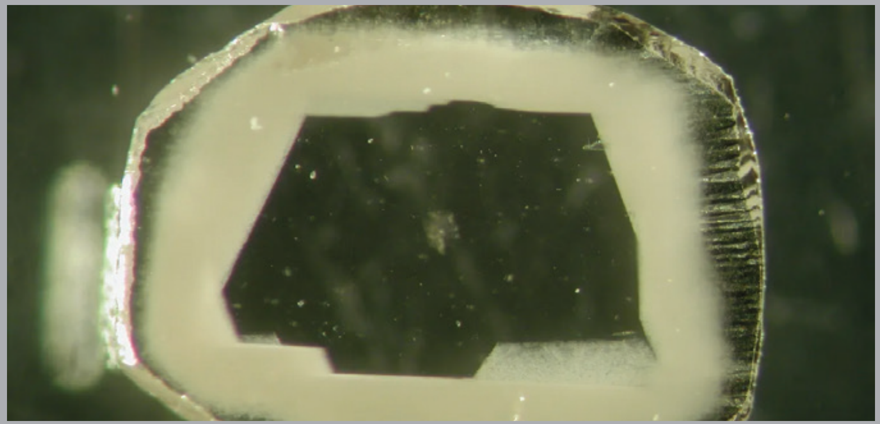
NICKEL NOTABLES

TESLA

Long live the battery

Tesla has patented an advancement that could greatly extend the lifespan of EV batteries by optimising the current high-energy-density nickel-cobalt-aluminium (NCA) lithium battery system. The main innovation involves doping the cathode active material with small amounts of other metallic elements during manufacturing, thereby improving charge retention, increasing resilience, and helping maintain a higher capacity over time. With a target lifespan for an electric battery of 1.6 million kilometres, "a critical point where battery life exceeds that of the vehicle," this advancement builds on research from 2019 by Jeff Dahn's team at Dalhousie University demonstrating 1-million-mile battery cells and a 2024 discovery by the same team of single-crystal electrodes capable of lasting for millions of miles. It's another significant step that promises to go the distance.

Diamond discovery



YAAKOV WEISS

It's a remarkable finding that shows diamonds are more than just valuable gemstones. Working with colleagues from the University of Nevada, the University of Cambridge, and the Nanocenter at the Hebrew University of Jerusalem, Yael Kempe and Yaakov Weiss's team identified nickel-iron metallic nanoinclusions and nickel-rich carbonate microinclusions trapped inside diamonds that formed between 280 and 470 km below Earth's surface. These inclusions provide one of the few natural records of conditions hundreds of kilometres beneath our feet, capturing a rare snapshot of a 'redox-freezing' reaction where oxidised melts infiltrate reduced mantle rock. This direct evidence of nickel-rich alloys deep within the Earth's mantle in South African diamonds is a first, confirming a long-sought validation of mantle redox models.

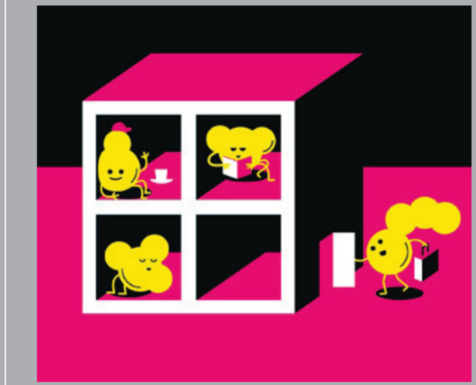
Increasing sensor sensitivity

YVONNE GRONER

A new technology, developed by a research team at the University of Missouri, mixes tiny crystals of platinum and nickel with ionic liquids. This innovation has produced a high-performance hydrogen gas sensor that allows early detection and warning of potential hydrogen fuel leaks. Hydrogen plays a role in clean fuel and healthcare, but even small leaks can lead to explosions or environmental damage. Previous sensors were costly and often unable to detect small leaks. With a detection limit of 107.1 parts per million, a rapid response time of 17 seconds, and a recovery time of 21 seconds, along with excellent selectivity and long-term stability, the breakthrough fingernail-sized sensor is not only quick to detect, efficient in size and cost, but it has proven superior performance and durability. The study was published in *ACS Sensors*.

Nobel Prize for MOFs

Scientists Susumu Kitagawa, Richard Robson, and Omar Yaghi from Australia, Japan, and the US were awarded the 2025 Nobel Prize in Chemistry for their pioneering work on metal–organic frameworks (MOFs). Through their decades-long research, they have developed molecular constructions with large spaces through which gases and other chemicals can flow. It all started in 1987; however, a key milestone was reached in 1997 when Kitagawa's team successfully developed three-dimensional MOFs with open channels using nickel, cobalt, or zinc ions and 4,4′-bipyridine. When they dried one of these materials, removing water, the spaces could absorb and release gases like methane, nitrogen, and oxygen without changing shape. It's been described as an attractive, spacious studio apartment, specifically designed for a water molecule! The future promise? A new molecular architecture with enormous potential that can be used to harvest water from desert air, extract pollutants from water, capture carbon dioxide, and store hydrogen and toxic gases or catalyse chemical reactions.



©JOHAN JARNESTAD/THE ROYAL SWEDISH ACADEMY OF SCIENCES

NICKEL INDUSTRY PART 6
NICKEL SULPHIDE PROCESSING

In Part 6 of this series we look at nickel sulphide processing. Sulphide ores occur predominantly in temperate to arctic regions, and less so in tropical locations. They can be at (or near) the surface or deep underground and often contain additional valuable metals such as cobalt, copper, platinum-group elements (PGE) and precious metals (PM).

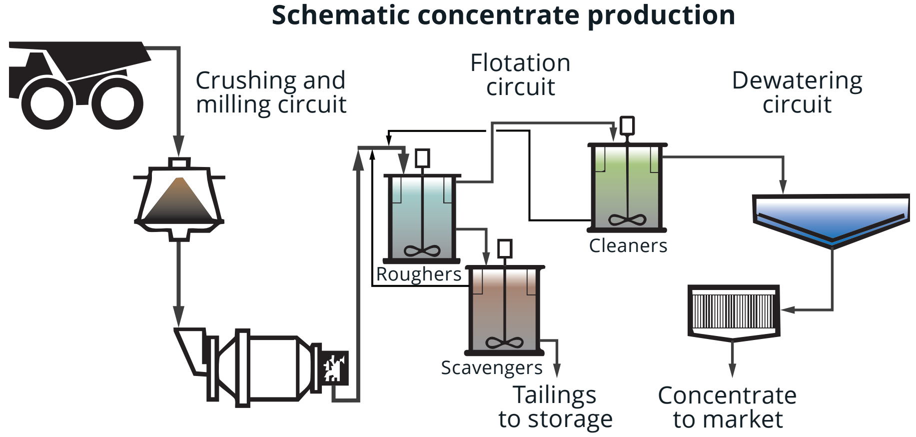
Nickel sulphide processing is more complicated than nickel laterite processing, in that there is no standard approach. This is very different from nickel laterite smelting to ferronickel and nickel pig iron, where there is very little substantial difference between the many dozens of facilities in the world. Typical nickel sulphide processing includes upgrading to a concentrate, then smelting to a nickel matte and refining of the matte to pure metal products.

Producing the concentrate

Upgrading of nickel sulphide ores is almost always done using froth flotation: the mined ore is crushed and ground to a silt or fine sand size (40 to 150 μm) then added as a water slurry to a bank of flotation cells, where a combination of additives is vigorously mixed with the slurried ore and air. The sulphide particles stick to the tiny air bubbles, and float to the top of the cell where they are collected in the froth. The non-sulphide gangue (waste rock) material sinks to the bottom and is discharged as flotation tailings.

Multiple banks of cells are used to complete the separation: 'roughers' to get most of the nickel sulphide, 'scavengers' to clean the remaining recoverable sulphides from the tailings, and 'cleaners' to reject any remaining gangue from the nickel sulphide concentrate. For multi-metallic deposits, differential flotation separates most of the copper from the nickel as a saleable copper concentrate. PMs tend to be associated with copper, and PGEs with nickel, but both are distributed across the concentrates. More than 95% of the mined ore mass is rejected at the mine site as tailings.

Schematic concentrate production



VALE

Aerial seeding program as part of Vale Base Metal's reclamation efforts near Sudbury, Ontario, Canada, on lands near its operations where sulphide ore has been mined.

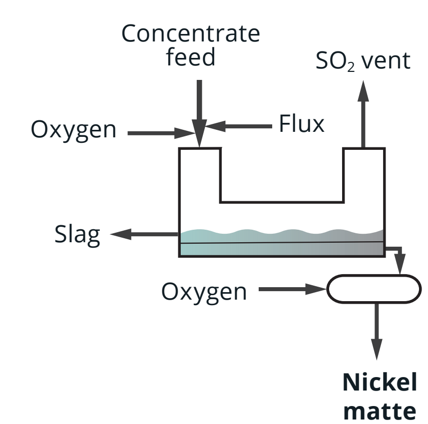
Pentlandite is the main nickel sulphide mineral, and its recovery is generally good, but depends on the size of the mineral grains. Coarse grains are separated from gangue fairly easily, but very fine grains may be entrapped in the gangue, exposing very little sulphide surface for bubble attachment. Additional recovery complications arise when other non-valued sulphide minerals, such as pyrrhotite, can be intimately associated with the pentlandite which dilutes the concentrate. Sometimes a sizable fraction of the nickel replaces iron in the pyrrhotite at an atomic level – but at concentrations too low to be economically viable. As a result, nickel concentrates are often in the range of 10-15% nickel, compared to 25-30% for copper and 50%+ for zinc.

Flash and roast EF smelting

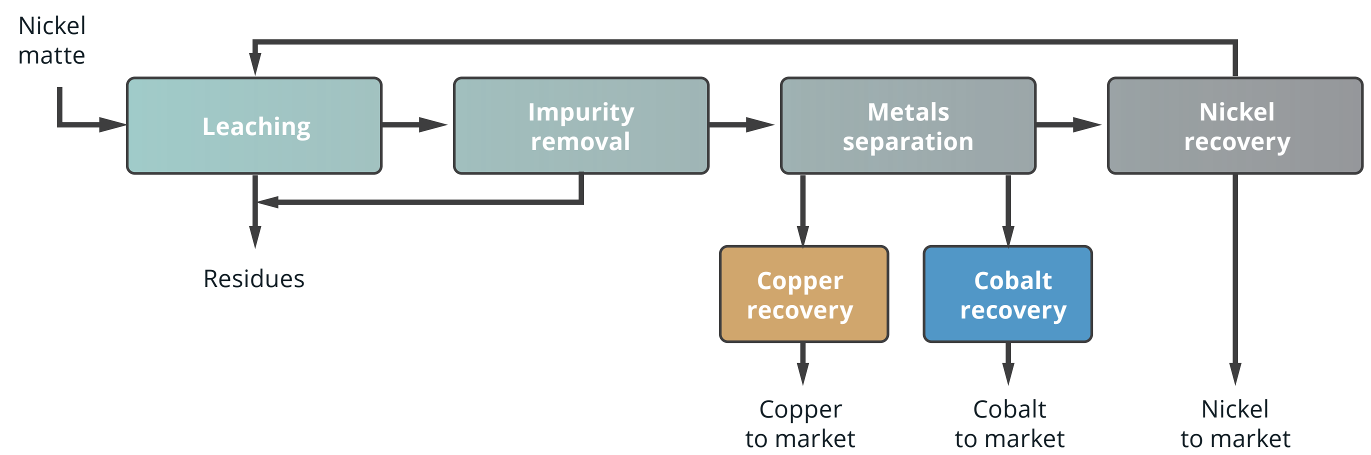
With high value per tonne, nickel concentrates can be treated locally or shipped globally. There are relatively few nickel sulphide smelters, but they often treat a variety of feed materials, blended to maintain a good furnace feed. The two primary methods of smelting are: flash smelting, and roaster with electric furnace smelting (roast-EF), both operating at high temperatures to melt the minerals (usually near 1400 °C), and both achieving high nickel recovery (95%).

Flash smelting uses an enriched oxygen gas to burn the sulphide minerals in a single large brick-lined vessel. The energy for melting the ore comes from partial combustion of the sulphur content, with sulphur dioxide collected from the vent and the molten minerals physically separating at the base of the smelter as matte (nickel-copper-cobalt-PGEs with remaining sulphur and some of the iron) and slag (oxide

Schematic flash smelter and converter



Schematic matte refinery



Recent innovations in nickel sulphide processing include:

- *Chloride-assisted sulphuric acid leaching at Long Harbour, Canada, which skips smelting and uses electrowinning to recover metals.*
- *Oxidative bioheap leaching in Finland, where metals are recovered by sulphide precipitation.*
- *Previously, direct concentrate leaching used the ammoniacal leach process.*

minerals). The matte is collected and sent to an additional processing vessel (converter) where it is processed to reject most of the iron to make a low-iron matte for refining. While smelter matte might be 20-30% iron, converter matte is <5% iron but still contains about 20% sulphur and 75% valuable metals. Some operations run the smelter to reject more iron and eliminate converting, but this requires slag cleaning to improve metals recovery.

Roast-EF smelting runs below the melting point to burn off sulphur and make a calcine that is then injected hot into an electric furnace where the final processing occurs. Smelter matte conversion is similar, and the same end goals are reached.

Refining nickel matte

Refining of converter mattes takes a number of forms, each complex in their own ways, and often custom designed to efficiently treat a certain range of nickel matte compositions.

Sulphuric acid leaching of matte with metals separation can be paired with electrowinning or hydrogen reduction for Class 1 nickel metal products.

Electrorefining can also be used to directly convert nickel matte cast as anodes to Class 1 cathodes.

Hydrochloric acid leaching of matte with metals separation is used with electrowinning of nickel to Class 1 cathode.

Carbonyl refining is a vapour phase process that uses a further pre-treatment of matte to metallise it, then reacts this with carbon monoxide to extract nickel and iron into the vapour space and then separately precipitate them as high-purity powders.

Ammoniacal leaching is also used to extract nickel-cobalt-copper which are separated and nickel recovered by hydrogen reduction. In all processes, most PMs and PGEs report to the extraction residues for potential recovery.

In most refining methods, copper is the 'easy' metal, so is separated from nickel and cobalt first, then nickel and cobalt separated from each other. This can be by solvent extraction, sequential precipitation in ammonia-based systems, and sequential recovery of nickel ahead of low levels of cobalt in the hydrogen reduction process.

We joke that there are as many flowsheets for nickel sulphide as there are nickel smelters and refineries – but it is not far off the truth! Ni

AEMWE TECHNOLOGY AND STAINLESS STEEL: A WINNING COMBINATION FOR SUSTAINABILITY

An ideal solution for green hydrogen production, AEMWE (Anion Exchange Membrane Water Electrolysis) technology represents a significant evolution compared to existing technologies, with both technical and economic advantages. Components at the 'heart' of green hydrogen production plant include bipolar plates made of nickel-containing stainless steel.

The heart of an electrolyser is the stack, a series of stacked electrochemical cells where the electrolysis reaction takes place.

One of the critical components of the stack is the bipolar plates that conduct electric current between cells and ensuring mechanical stability.

To ensure longevity and resistance in the chemically aggressive environment of an electrolyser (where potassium hydroxide is present, albeit at low concentrations), these components are made of EN 1.4404 (Type 316L UNS S31603) stainless steel. Developed by a company based in the northeast of Italy, these AEMWE devices are demonstrating great benefits.

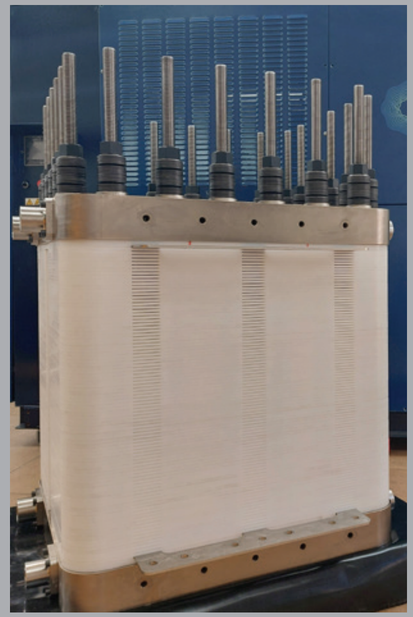
Compared to alkaline electrolysis, which is lower cost but limited efficiency, and PEM (Proton Exchange Membrane) technology, which guarantees high performance at a higher cost, AEMWE strikes a balance between cost and performance.

The choice of AISI 316L stainless steel has also proven successful for the electrolyser's piping, which transports gases and liquids within the plant.

In this case, corrosion resistance is critical because the pipes are exposed to potassium hydroxide, acting as an electrolyte, as well as to the hydrogen produced by the stack, which can cause embrittlement in steels.

These AEMWE technological advancements containing stainless steel at the 'heart' contribute to supporting the transition to a green hydrogen-based economy, reducing environmental impact, and promoting the large-scale adoption of renewable energies. Ni

This article first appeared in Inossidabile 237, *December 2024, published by Centro Inox and reproduced with permission.*



INOSSIDABILE 237

Anion Exchange Membrane Water Electrolysis (AEMWE) stack used for green hydrogen production

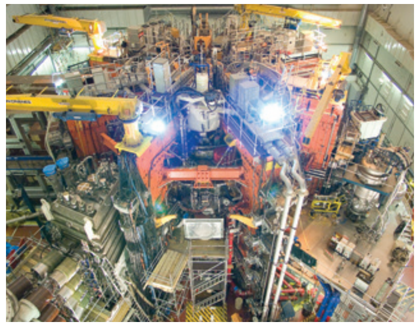
INOSSIDABILE 237

A 10 kW AEMWE stack installed in the electrolyser

BUILT FOR THE EXTREME

NICKEL'S PART IN FUSION INNOVATION

In 2024, The EUROfusion team's Joint European Torus (JET), one of the world's most powerful fusion tokamak machines, based in the UK, set a world record in energy output and proved reliable fusion generation using deuterium-tritium fuel. The team's work in materials testing, component development, and fusion science will accelerate progress of ITER, being developed in France, and show the fusion community has the capability to model what will happen in a fusion reactor.



JET Torus Hall at UKAEA's Culham Campus

Nuclear fusion is the process of merging light atomic nuclei, like hydrogen, to form a heavier nucleus, like helium, releasing immense amounts of energy. Fusion does not generate long-lived radioactive waste and thus could provide a clean, nearly limitless, carbon-free energy source that doesn't produce greenhouse gases.

In the Sun, massive gravitational forces create the right conditions for fusion, but on Earth they are much harder to achieve. Fusion fuel – different isotopes of hydrogen – must be heated to extreme temperatures, of the order of 150 million °C, ten times the temperature at the core of our Sun, to produce plasma, an electrically charged gas made of a mix of positively and negatively charged particles. Plasma must be kept stable under intense pressure, hence dense enough and confined for long enough to allow the nuclei to fuse.

The most common experimental fusion reactors are tokamaks, which use strong magnets in the reactors to keep the plasma confined. Tokamaks are doughnut-shaped (toroidal) chambers with magnetic coils. The magnetic forces constantly spin the particles around their reactor chambers to prevent the plasma escaping. Nickel-containing stainless steel is important in the manufacture of tokamaks.

The International Thermonuclear Experimental Reactor (ITER) currently under construction in southern France will be the largest magnetic confinement fusion (MCF) reactor ever built.

Three major ITER components manufactured from stainless steel are:

- The vacuum vessel fabricated from 316LN (S31653) which contains the plasma. The superconducting magnets of the vacuum vessel must be cryogenically cooled by liquid helium to -269 °C, to achieve their superconductivity and thus develop the required magnetic field to contain the plasma. 316LN is selected for its low magnetic permeability, strength, cryogenic toughness and fatigue resistance.
- 40 blanket modules covering the inner walls of the vacuum vessel are made from beryllium, high-strength copper and stainless steel. The 40 mm-thick shielding plates made from borated stainless steel 304B7 (S30467) with about 2% boron content are used for neutron shielding.
- The cryostat, which encompasses the vacuum vessel is manufactured from dual certified 304/304L (S30400/S30403). The cryostat provides the high vacuum environment for the superconducting magnets of the vacuum vessel. The high vacuum provides an insulating layer, like the wall of a thermos flask, to conserve the cold which is essential for ensuring the superconductivity of the magnet system. Ni

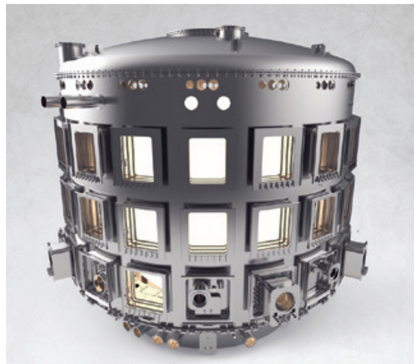
One of nine segments that make up the vacuum vessel fabricated from 316LN. The weight of the completed vacuum vessel is 5200 tonnes.

New nickel steel enables more compact reactor designs

Meanwhile in China, scientists have developed a new nickel-containing stainless steel known as China High-Strength Low-Temperature Steel No 1 (CHSN01). It is reported to withstand magnetic fields of up to 20 Tesla in comparison to the 11.8 Tesla for 316LN, and with higher tensile strength and superior fatigue resistance at cryogenic temperatures.

The ability of CHSN01 to withstand stronger magnetic fields allows for more effective confinement of the superheated plasma. With stronger magnetic fields, a given amount of plasma can be held in a smaller volume, meaning the overall size of the reactor's core can be reduced. This directly translates to more compact reactor designs, potentially leading to significant reductions in the physical footprint and material volume required for construction. CHSN01 is reported as a modification of Nitronic® 50 (S20910).

Cr%	Ni%	Mn%	Mo%	N%	Si%	V%	Nb%	C%	P%	S%
22.1	14.6	5.22	2.1	0.31	0.3	0.19	0.09	0.008	0.005	0.002



The cryostat fabricated from 304/304L, is the world's largest high-vacuum pressure chamber, weighing 3850 tonnes. It surrounds the vacuum vessel maintaining the ultra-cool, high-vacuum environment necessary for the tokamak to operate.

BONDED FOR PERFORMANCE:
NICKEL'S INNOVATIVE ROLE IN CLAD PLATE TECHNOLOGY

Clad plate finds application in pressure vessels such as separators for oil and gas, autoclaves in mineral processing, scrubbers for flue gas desulphurisation in coal-fired power plants and tanks for chemical processing.

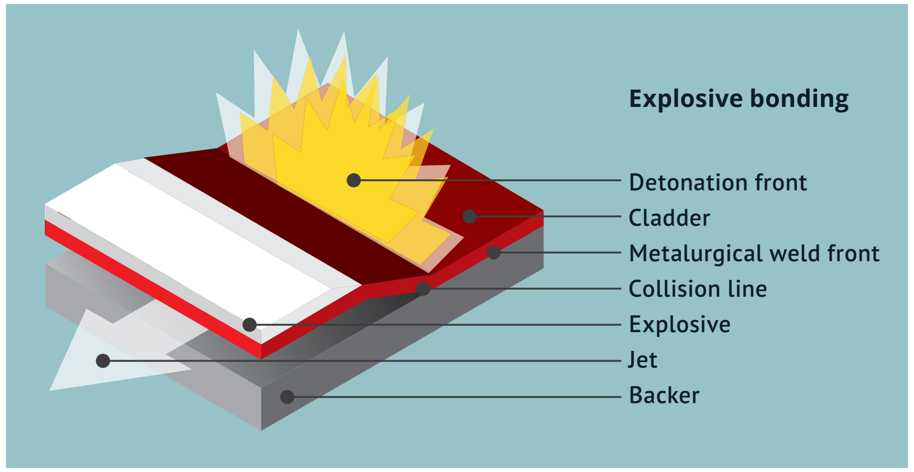
Stainless steels and nickel-based alloys (corrosion-resistant alloys – CRA) are well known for their outstanding corrosion resistance. However, their high cost becomes a concern in applications where thick material is required. Fortunately, these alloys can be clad to lower cost carbon steel plate producing a composite product.

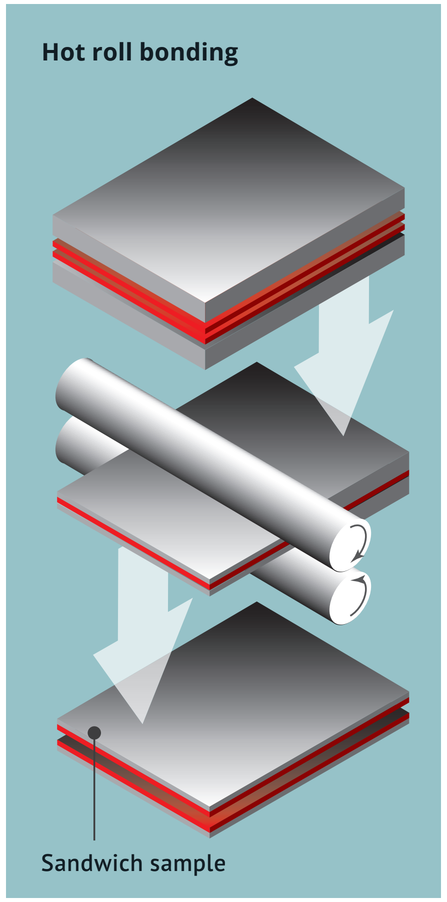
CRA clad plate is an engineered material that combines the strength and economy of a carbon or low-alloy steel base with the corrosion resistance and durability of CRA. By metallurgically bonding a CRA layer (typically 3mm thickness) to a lower cost steel plate, industries gain performance benefits while reducing cost compared with using solid CRA. Several proven technologies – explosive bonding, hot roll bonding, and weld overlay – are used to manufacture CRA clad plate, each offering distinct advantages.

Clad plate finds application in pressure vessels such as separators for oil and gas, autoclaves in mineral processing, scrubbers for flue gas desulphurisation in coal-fired power plants and tanks for chemical processing.

Explosive bonding

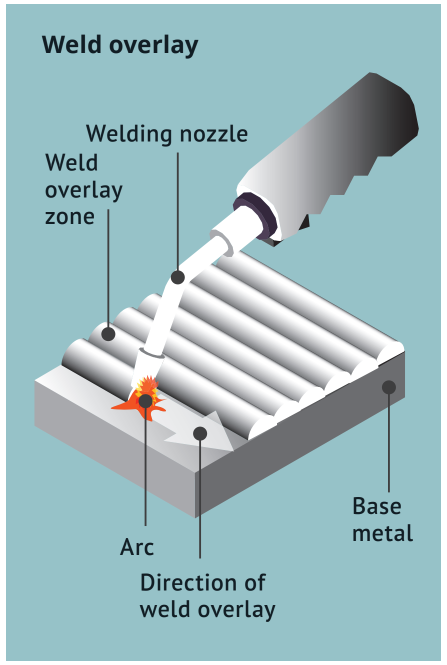
Explosive bonding uses controlled detonation to accelerate a CRA plate (the cladding layer) onto a base steel plate at extremely high velocity. The impact creates a metallurgical bond without melting, maintaining the integrity of both materials. The process allows production of large, thick plates with excellent bond strength. Because there is no bulk heating, mechanical properties of the steel and the corrosion resistance of the CRA remain intact.





Hot roll bonding

Roll bonding is a more conventional process, in which a CRA is metallurgically bonded to a lower-cost and stronger steel base through hot rolling. Specifically, this process is achieved by assembling a 'sandwich' of backing and cladding materials. Parting compound separates each clad pack. The edges of the metal stack are welded together to hold the materials in place during the rolling process. After the required size is achieved by hot rolling the pack is separated into two separate clad plates. This technique is efficient and highly repeatable for producing large volumes of clad plate with uniform quality and precise thickness control.

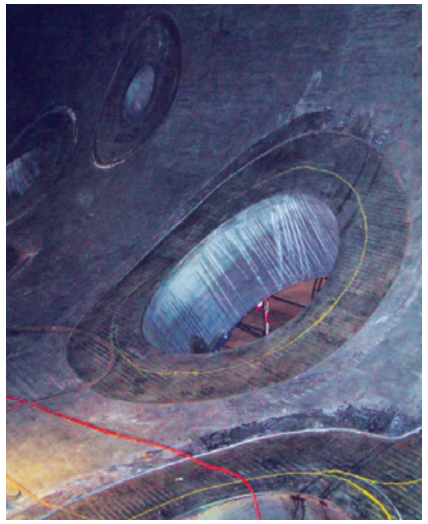


Weld overlay

Weld overlay involves depositing a layer of CRA onto a steel base plate using welding techniques. It can be performed by virtually any welding process applicable to the job size. This allows flexible application of the CRA only where needed, reducing overall material costs. Weld overlay is particularly valuable for repairing or upgrading existing equipment, as well as fabricating components with complex geometries.

Benefits

Each cladding method – explosive bonding, hot roll bonding, and weld overlay – offers unique benefits. Explosive bonding provides a strong bond between the clad and base layer; hot roll bonding delivers uniform, economical large-scale production; and weld overlay enables targeted corrosion resistance and design flexibility. Together, these technologies ensure CRA clad plate remains a versatile and cost-effective solution for demanding industries such as oil and gas, mining, chemical processing, power generation, and marine engineering. Ni



GEIR MOE, NICKEL INSTITUTE

Nickel alloy weld overlay around nozzle opening provides corrosion and erosion resistance to flowing acidic process solution inside Pressure Oxidation Autoclave.

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: What is the hottest temperature that Type 304 (S30400) and Type 316 (S31600) stainless steel can be used at?

A: The short answer is in the range of 480°C to 925°C (900°F to 1700°F) depending on what property of the metal is most important for the application.

There are primarily three material characteristics that need to be considered – avoidance of metal loss due to scaling (the formation of a surface layer created by reaction of the metal with the surrounding hot gas); strength at temperature; and the susceptibility of the metal to undergo microstructural change at temperature which would compromise the metal's toughness.

In air, above 925°C (1700°F) Type 304 and Type 316 will begin to scale rapidly and will lose mass as the scale falls away. If the temperature fluctuates, the difference in expansion and contraction of the underlying metal and surface scale will accelerate the spalling of the scale and the maximum temperature would be 870°C (1600°F) in air. Nickel in Type 304 and Type 316 is beneficial in reducing the thermal expansion differential at the base metal-oxide interface during cooling. If there are other contaminants in the hot gas, for example hydrogen sulphide or sulphur dioxide, the acceptable temperature will be less than 925°C.

If mechanical strength is an important factor, be aware that as temperature increases, strength drops. Thus, the load that the metal can carry will be reduced. However, at a temperature around 480°C (900°F) these stainless steels will start to experience metal creep. This is the slow, time-dependent, permanent deformation of a solid metal under the continuous application of mechanical stress at elevated temperatures, even if the stress is below the material's yield strength. Nickel in these stainless steels promotes the austenite microstructure which gives them their superior creep strength in comparison to plain carbon steel.

And toughness at room temperature can be significantly reduced when there is exposure to elevated temperatures which cause detrimental changes in the metal's microstructure. Fortunately, in the case of Type 304 and Type 316, their microstructures are stable and do not undergo detrimental microstructural changes that drastically reduce room temperature toughness. Ni

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?

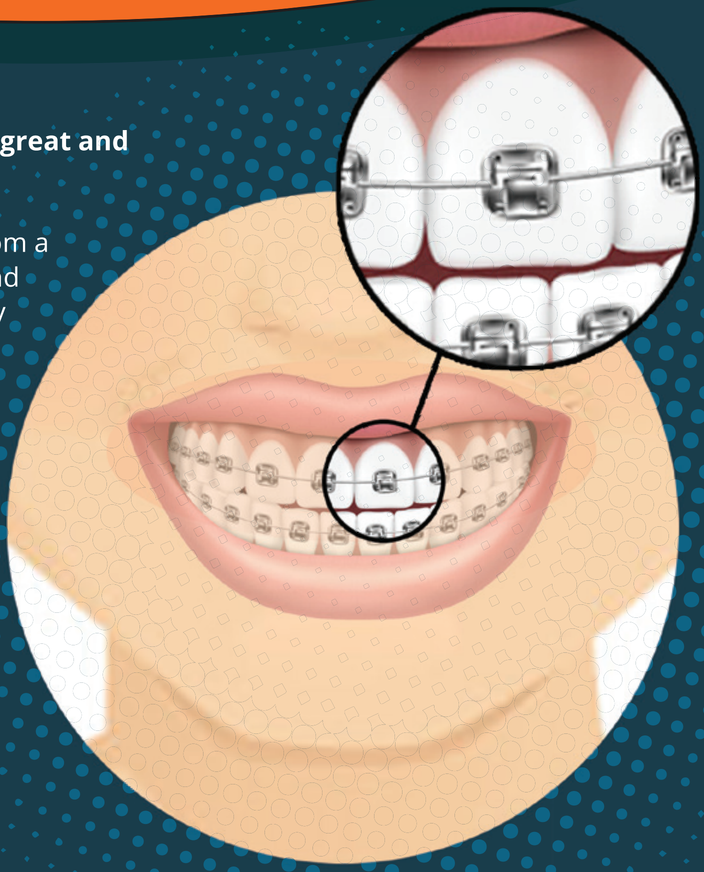
NICKEL IN DENTAL BRACES

Braces help straighten teeth so your smile looks great and your bite works the way it should.

Modern braces often use a special wire made from a metal mix called Nitinol, which contains nickel and titanium. Nitinol is unique because it can actually 'remember' its shape! When the wire warms up in your mouth, it slowly moves back to its original form, gently guiding your teeth into place.

This smart metal means:

- Braces don't need to be tightened as often.
- They're more comfortable and work faster than older types.
- The metal is strong, safe for your body, and doesn't rust.



UNS DETAILS

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

UNS	B	C	Co	Cr	Cu	Fe	Mn	Mo	N	Nb	Ni	P	S	Si	T	V
S20910 p 11	-	0.06 max	-	20.5-23.5	-	bal	4.00-6.00	1.50-3.00	0.20-0.40	0.10-0.30	11.5-13.5	0.040 max	0.030 max	1.00 max	-	0.10-0.30
S30400 P 11, 14	-	0.08 max	-	18.0-20.0	-	bal	2.00 max	-	-	-	8.0-10.5	0.045 max	0.030 max	1.00 max	-	-
S30403 p 11	-	0.030 max	-	18.0-20.0	-	bal	2.00 max	-	-	-	8.0-12.0	0.045 max	0.030 max	1.00 max	-	-
S30467 p 11	1.75-2.25	0.08 max	0.2 max-	18.0-20.0	-	bal	2.00 max	-	0.10 max	-	12.0-15.0	0.045 max	0.030 max	0.75 max	-	-
S31600 p 2, 14	-	0.08 max	-	16.0-18.0	-	bal	2.00 max	2.00-3.00	-	-	10.0-14.0	0.045 max	0.030 max	1.00 max	-	-
S31603 p 9	-	0.030 max	-	16.0-18.0	-	bal	2.00 max	2.00-3.00	-	-	10.0-14.0	0.045 max	0.030 max	1.00 max	-	-
S31653 p 11	-	0.030 max	-	16.0-18.0	-	bal	2.00 max	2.00-3.00	0.10-0.16	-	10.0-14.0	0.045 max	0.030 max	1.00 max	-	-
N01555 p 15	-	0.07 max	0.05 max	0.01 max	0.01 max	0.05 max	-	-	-	0.025 max	54.0-57.0	-	-	-	bal	-

UNITATIS: UNITY AND SOLIDARITY

Crafted entirely by 23-year-old metal artist Martin Rehrl during the Covid pandemic, the monument is made from six tonnes of nickel-containing stainless steel and features over 16 km of welds.

Two clasped hands, standing nine metres tall and made of six tonnes of nickel-containing stainless steel, are travelling the world as a symbol of unity and solidarity. Created by Austrian artist Martin Rehrl during the COVID pandemic, the 23-year-old artist isolated himself in a large warehouse, spending 1500 hours completing the sculpture Unitatis. *Made from metal struts and containing over 16 km of welds, Rehrl completed the structure entirely on his own. He used a self-lifting platform and cable winch, then laid the piece down and turned it on its own axis to reach the top. At its widest point,* **Unitatis** *measures 2.55 metres in diameter.*

Filmmaker Daniel Ronacher chronicled the entire process of creating the sculpture in a documentary titled *Salzburg. Eine Kunstgeschichte* (*Salzburg. A history of art*), an exploration of how difficult times influence art. The artist's goal was to show the world that coming together in times of crisis makes us stronger.

Rehrl's vision is to have Unitatis reach places where unity is most needed. It was unveiled in Salzburg, Austria, in 2021 and has travelled to Schengen, Luxembourg, and in 2024, Unitatis was installed in Brussels' Cinquantenaire Park. Designed to last for eternity, this work of art should still be standing proudly in 5000 years. Ni