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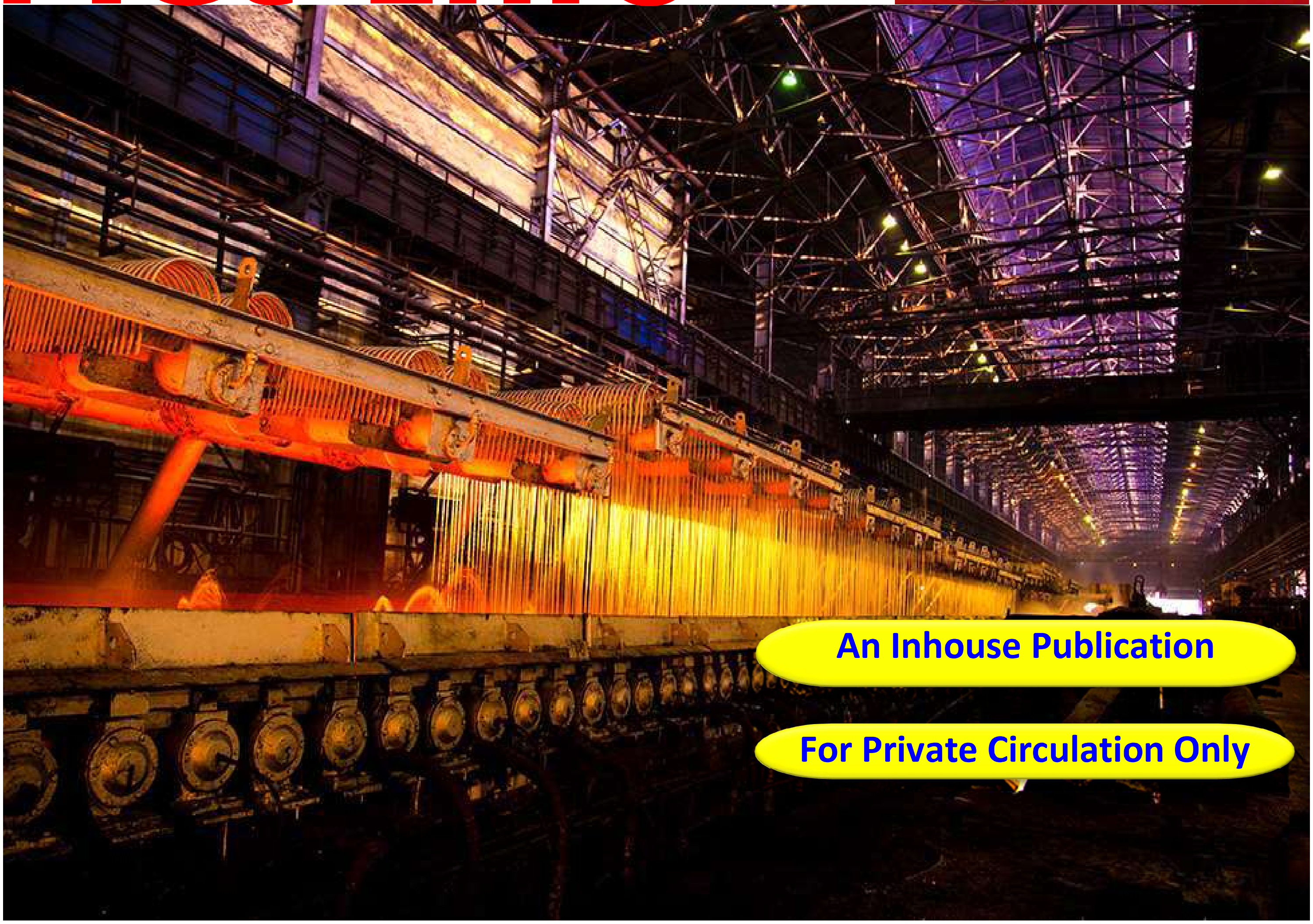

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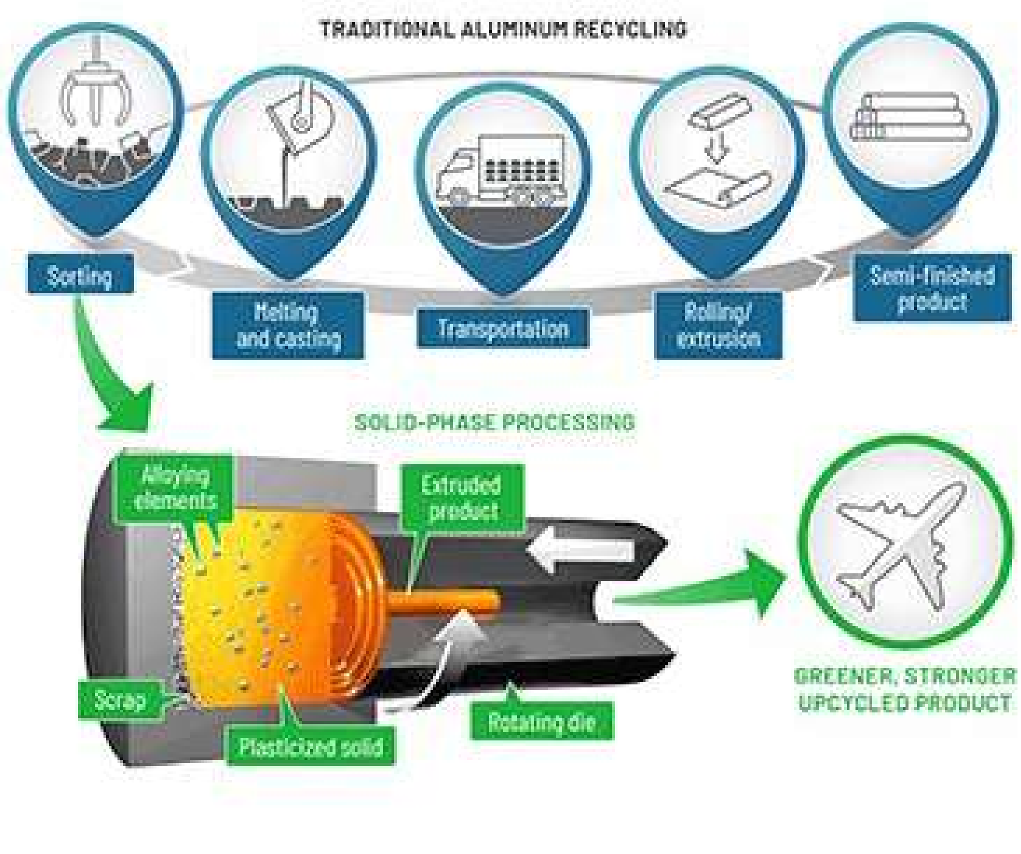
Solid Phase Alloying to Transform Recovered Aluminium into High-performance Alloys without Melting

The solid phase alloying process can convert aluminium scrap blended with copper, zinc and magnesium into precisely designed alloys in minutes.

Research at the Department of Energy's Pacific Northwest National Laboratory (PNNL), Richland, Washington, published in *Nature Communications* reveals that metal scrap can be transformed and upgraded directly into high-performance, high-value aluminium alloys without conventional melting process.

The study demonstrates that aluminium manufacturing scrap can be transformed into metal alloys through a new method called *solid phase alloying* that perform on par with identical materials produced from primary aluminium, indicating this approach can provide a low-cost, environmentally sustainable pathway to bringing more high-quality recycled metal products to the marketplace.



A new solid phase alloying process eliminates the need for the costly and energy-intensive melting, casting and extrusion process currently used for aluminium recycling.

The novelty of the work here is that by adding a precise amount of metal elements into the mix with aluminium chips as a precursor, one can actually transform it from a low-cost waste to a high-cost product. It is done in just a single step, where everything is alloyed in five minutes or less.

The solid phase alloying process converts aluminium scrap blended with copper, zinc and magnesium into a precisely designed high-strength aluminium alloy product in a matter of minutes compared with to the days required to produce the same product via conventional melting, casting and extrusion. A PNNL-patented technique called *Shear Assisted Processing and Extrusion*, or *ShAPE*, is used to achieve the results. The researchers claims that the findings should be reproducible with other solid phase manufacturing processes.

Through the *ShAPE* process, a high-speed rotating die creates friction and heat that disperses the chunky starting ingredients into a uniform alloy with the same characteristics as a newly manufactured aluminium wrought product. The solid phase approach eliminates the need for energy-intensive bulk melting, which combined with the low-cost feedstocks originating from scrap, has the potential to sharply reduce the cost of manufacturing these materials.

The team used mechanical testing and advanced imagery to examine the internal structure of the materials produced through solid phase alloying, showing the *ShAPE* alloy imparts a unique nanostructure at the atomic level. During *ShAPE*, atomic-scale features, called Guinier-Preston zones, form within the alloy, which are known to improve strength in metal alloys. Compared with conventional recycled aluminium, these alloys are 200 percent stronger and have increased ultimate tensile strength, which could translate into longer-lasting and better-performing consumer products.

The solid phase alloying is not just limited to aluminium alloys and junk feedstocks. It is theoretically applicable to any metal combination that one can imagine, and the fact that manufacturing occurs wholly in the solid state means one can begin to consider totally new alloys that has not been made before.

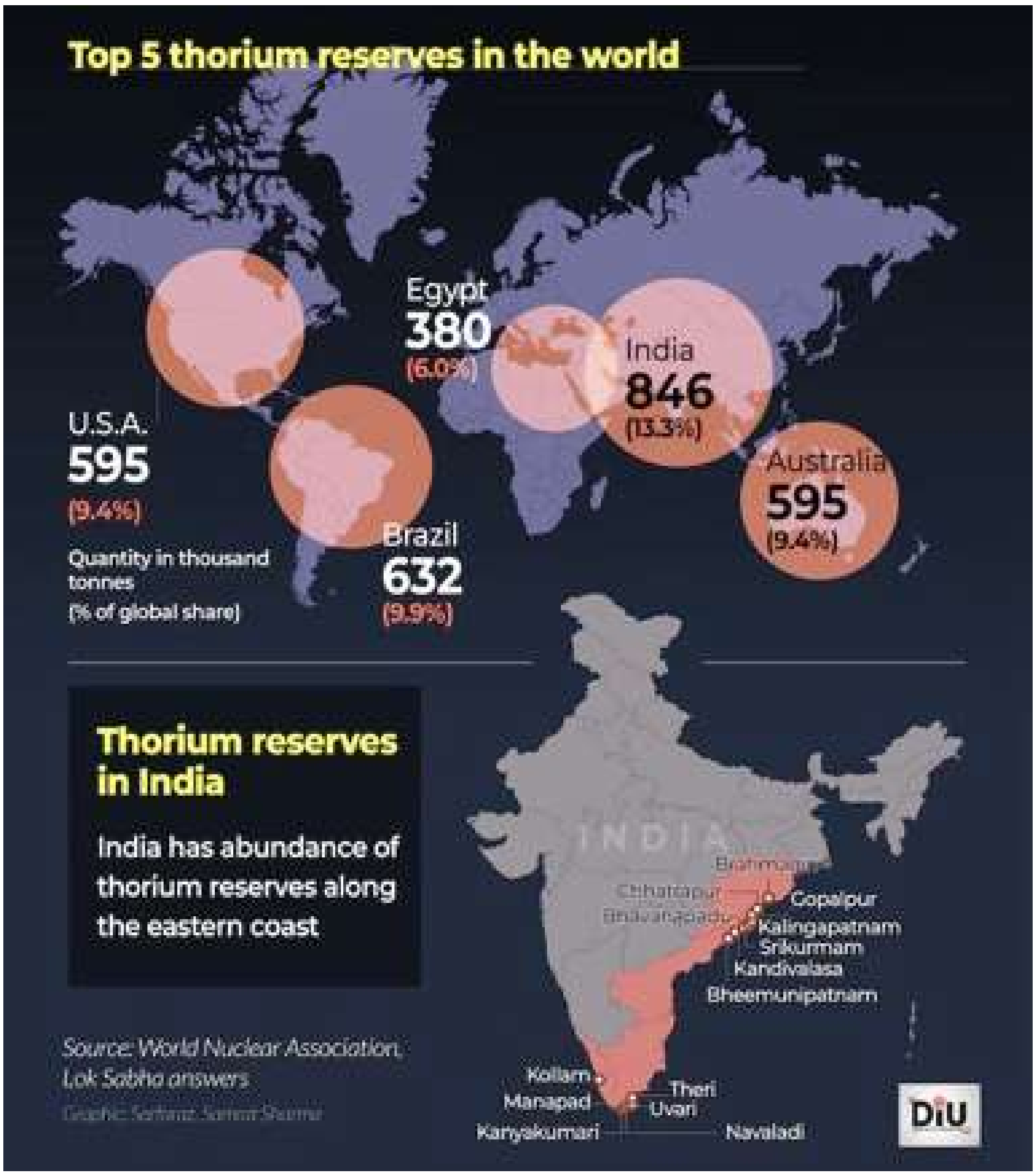
The solid phase alloying process could be used to create custom metal wire alloys for various 3D printing technologies. For example, *wire arc additive manufacturing*, or

WAAM, is used to 3D print or repair metal parts. In this process, a roll of wire feeds into a robotic welding torch, which melts it to build 3D parts.

It's difficult to obtain feed wires with customized compositions for wire-based additive manufacturing. Solid phase alloying is a fantastic way to produce tailored alloys with exact compositions such as 2 percent copper or 5 percent copper."

Source: Recycling Today, 23 Dec. 2024

India has World's Largest Share of Thorium



Source: World Nuclear Association

India's Search for Critical Minerals to Boost Tech, Clean Energy Industries

India has upped search for critical minerals with the Geological Survey of India (GSI) taking up 195 exploration projects in field season 2024-25 that is nearly half of the 433 exploration projects carried out in the previous three field season (2020-21 to 2023-24). There are 16 Critical Mineral Assessment Programmes (CMAP) – where the GSI identifies secondary enrichment zones - in 10 states including Madhya Pradesh, Maharashtra, Jharkhand, Odisha, Andhra Pradesh, Karnataka, Kerala, Telangana, Manipur and Meghalaya.

India has a list of 24-odd critical minerals and a reserve of at least 17 that it has discovered or recorded. These minerals are important for the future as they support industries like technology, defence, and clean energy. By exploring and securing these resources, India aims to reduce dependence on imports and strengthen its position in the global supply of critical minerals.

Mineral Blocks

Out of 48 critical mineral blocks put up for auction in four tranches, 24 have been successfully auctioned. There are close to 40 million tonnes (mt) of graphite, spread across Chhattisgarh, Jharkhand, Kerala. Odisha, Tamil Nadu Andhra Pradesh, Arunachal, Madhya Pradesh at various cut-offs and grades. Similarly, phosphorus (rock phosphate) reserves are pegged at 31 mt, primarily across two states – Madhya Pradesh and Rajasthan. There are also over 16 mt of titanium reserves available in Kerala, Maharashtra, Odisha and Tamil Nadu and 41 mt of in Jharkhand and Uttar Pradesh.

Some of the other critical mineral reserves – initially considered to be less than 1 mt – include zirconium in Kerala, Odisha and Tamil Nadu; and tin in Chhattisgarh.

Augmentation

The resource augmented across States by GSI since MMDR Amendment Act, 2015, covers another 15 critical minerals. There are 230 mt of rare earth element (REE – RM) resources across eight states, with the highest - 192.67 mt, being in Gujarat, followed by 30.51 mt in Assam; around 282 mt of niobium in Gujarat; 830 mt of glauconite / potash with largest deposits being reported from Rajasthan and Bihar.

Other large resources include that of lithium - 5.9 mt in J&K; 6.4 mt in Rajasthan; 74 mt of gallium in Chhattisgarh (30.5) and Madhya Pradesh (28.7 mt); and 71 mt of vanadium – mostly in Chhattisgarh, Jharkhand and MP. Smaller reserves – of less than 5 mt – have been reported across minerals like platinum group of elements (Tamil Nadu and Maharashtra), tin (3 mt in Haryana) and molybdenum (Tamil Nadu – 1.7 mt).

Source: The Hindu Businessline, 23rd December 2024

JSW Steel Installing Integrated Casting and Rolling Plants at Dolvi

JSW Steel (Dolvi Works) is installing an integrated casting and rolling plant, the third of its kind worldwide, which not only promises maximum productivity but also expands the product mix in terms of widths and thicknesses. It aims to achieves peak values with regard to performance, efficiency and carbon reduction. SMS will construct the plant at Dolvi site and put it into operation in 2026.

Plate and strip from the same, fully integrated casting and rolling plant

JSW has been operating a typical CSP® plant very successfully since 1998. SMS has advanced this plant technology with every order. With each new order, SMS develops tailor-made solutions for specific market and customer requirements. Having put into operation the world's first CSP® Nexus plant for American steel producer SDI in Sinton, Texas in 2022, SMS group is currently implementing the first fully electrified CSP® Nexus facility for H2 Green Steel in Sweden. While H2 Green Steel is placing a strong focus on bringing steel production emissions close to zero, the CSP® Nexus technology in this new plant for JSW Steel (Dolvi Works) is setting new standards in terms of productivity and dimensions of the final hot rolled products.

For the first time, hot strip and plate for shipbuilding, wind towers, heavy pipeline grades (API) or alike with a maximum width of 2,600 milli-meters can be produced on a single plant that comprises casting and direct rolling. The hot strip thickness range of 2.0 to 32.0 milli-meters is exceptional and offers JSW Steel (Dolvi Works) a unique opportunity to open up new markets at a competitive cost level, particularly in the field of "green plate" production. With parameters like these, the CSP® Nexus plant for JSW Steel (Dolvi Works) is not only setting standards for thin slab casting and rolling plants, but also for conventional hot strip mills.

The scope of supply includes a single-strand caster with high throughput, a multi-stand roughing mill that can reduce the slab thickness to the optimal transfer bar thickness, and a six-stand finishing mill. A highly advanced laminar cooling system and three down coilers are completing the plant. The scope of supply also comprises all the automation technology for controlling the plant, including drive engineering and the array of technology packages, which feature sophisticated process models for automation solutions. With an annual capacity of four million tons, this is the highest capacity for a single-strand caster of this type anywhere in the world. Provision is made for a plant extension, either a second casting strand or a lateral slab feeding facility, to further boost the productivity to more than seven million tons in future.

The bow-type casting machine is capable of casting slabs up to 160 milli-meters. This ensures an appropriate reduction ratio for particularly thick products and allows for a production throughput of up to 8.5 tons per minute and, going forward, has the potential to deliver ten tons per minute.

Three roughing stands, located downstream of the first tunnel furnace, ensure the full range of transfer bar thicknesses. Even with larger slab dimensions, thin strip can be rolled. Roughing and finishing mill are decoupled by a heated roller table, thus the roughing stands operate at highest rolling speed rates to meet the relevant temperature requirements and increase the overall energy efficiency of the plant.

In addition to the three roughing stands, a high-performance six-stand finishing mill ensures the desired hot strip thickness range.

The laminar cooling section comprises nine super-reinforced micro-zone groups, which are designed to ensure both plant productivity and the mix of product dimensions. Three extremely robust down coilers complete the CSP® Nexus line.

- CSP® Nexus offers customized solutions for customers' individual needs and extends the range of producible hot strip dimensions to include plate products up to 2,600 milli-meters width.
- **Integrated flexibility:** For the first time, both hot strip and plate in these dimensions can be produced on one mill, meaning maximum flexibility
- **Sustainable innovation:** CSP® Nexus not only achieves peak productivity, it also sets new standards in efficiency and carbon reduction
- **Top performance worldwide:** JSW's CSP® Nexus is the third of its kind and with its annual productivity of four million tons, the most productive and powerful in the world

Furthermore, SMS group equips the facility with a toolset of digital solutions that provide for the efficient use of plant data. By integrating the SMS DataFactory, the QES quality management system, and the GeniusCM condition monitoring software into the production processes, JSW will benefit from remarkable improvements in both efficiency and predictability. These innovative tools enable real-time data analysis, and data-driven decision-making, ultimately improving overall production quality and performance.

In contrast to other available thin slab casting and rolling concepts, CSP® Nexus is not just putting focus on a rather limited range of final products. CSP® Nexus offers a tailor-made solution best fitting for the individual customer needs, which in case of JSW STEEL (Dolvi Works) are highest productivity with reduced energy consumption and CO_2 footprint in combination with a boundary breaking range of final product dimensions." says Cosimo Cecere, Head of Integrated Process Solutions Casting and Rolling Plants.

Source: SMS group #Connect update - Review 2024

Advanced Super-scale Electric Steelmaking Plant

SMS group is supplying one of the world's strongest Alternate Current-Electric Arc Furnaces (AC-EAF) and its auxiliaries to Saarstahl in Völklingen, Germany. This will contribute to SHS' goal to achieve carbon neutrality by 2045. With an installed power of 300 MVA, the new EAF is the biggest ever built by SMS group.

The new 185-tons EAF will be built within an already defined brownfield area. With a transformer capacity of 300 MVA, it will be one of the strongest EAF in the world. Additionally, it will process a flexible mix of up to 100 percent scrap or 80 percent Cold Direct Reduced Iron (CDRI)/ Hot Briquetted Iron (HBI) and 20 percent scrap.

Featuring 9.3-meter shell-diameter - the largest EAF ever built by SMS group - it will have an annual capacity of 1.9 million tons of liquid steel. This investment aligns with SHS's strategic plan to utilize a mix of 70-85 percent natural gas and 30-15 percent hydrogen as an energy source by 2030, significantly reducing carbon emissions.

With phase I starting in October 2024 and the first heat expected in September 2028, the plant will produce various steel grades, including bearing steel, free-cutting steel, and spring steel.

The EAF will be equipped with Condoor®, SMS' enhanced slag door, ensuring significant advantages in terms of safety, productivity, energy savings and environmental impact. Condoor® enables automatic operation, reduces power-off time, ensures a clean slag door sill, saves energy and lowers NO_x emissions with a sealed shell. Additionally, it optimizes slag residence time, improving flux and raw material use while reducing electrode, carbon and lime consumption, thus lowering CO_2 footprint.

Part of the scope is also a material handling system with bins designed for specific production grades, a liquid steel handling, refractory repair area, a water treatment plant, compressed air piping, two fume treatment plants, energy recovery and electric/automation systems, noise insulation, hybrid technology cars for scrap bucket movements, auxiliary cranes as well as bay and field piping.

The EAF will feature SMS group's advanced X-Pact® automation, including sensors for leakage detection and for safe and automated tapping, for predictive maintenance, enhancing operational efficiency and safety. Additional innovations include automatic cleaning of the Eccentric Bottom Tapping (EBT) channel to ensure the highest rate of spontaneous EBT opening, for automatic sand filling, temperature taking and exchange of probes.

Source: SMS group #Connect update - Review 2024

Biocarbon as a Reductant in Ferrochrome Plant

Stainless steelmaker Outokumpu is investing €40 million for the construction of a biocarbon production plant in Germany. The plant will be built in the state of Mecklenburg-Vorpommern in Northeastern Germany, utilizing existing infrastructure and buildings at the Mukran Port. The planned annual production capacity is 15kt of biocarbon using waste wood as raw material. The commissioning of the site is scheduled for the first half of 2026. The new plant will provide feedstock material for biocoke to Outokumpu's pelletizing plant in Tornio, Finland, which is expected to be completed mid-2025. Biocoke is used as a reductant in Outokumpu's ferrochrome production.

Approximately 50% of Outokumpu's direct emissions could be reduced by replacing fossil coke with biocoke, the company has said.

Outokumpu claims to progressing steadily towards their target to reduce their emission intensity across direct, indirect and supply chain emissions by 42% by 2030 from a 2016 base year. Beside biocoke, Outokumpu is investigating also other innovations as well as the use of carbon capture technology to achieve further reductions.

Source: Weekly News from Steel Times International, 18 Dec. 2024

Green Steel - What Lies Ahead in 2025

The steel industry will reach an historic milestone in 2025, with Sweden expected to produce the world's first truly zero-carbon emission steel. This breakthrough marks more than just a technological achievement – it is the dawn of a new era that will reshape pricing, markets, and supply chains. For stakeholders across the steel value chain, this moment presents both unprecedented challenges and enormous opportunities. As the world prepares for the arrival of carbon emission-free steel, it is critical to understand the implications for pricing models, market dynamics, and the way supply chains will need to evolve. The key question for the industry is no longer whether zero-carbon steel will happen – it is how to adapt to a world where it becomes the norm. To succeed, stakeholders must adopt new strategies, embrace transparency, and collaborate more deeply than ever before.

Steel mills: balancing innovation with viability

Steelmakers are at the forefront of the green transition, embracing hydrogen based direct reduction iron (DRI) in Europe and scrap-based electric arc furnace (EAF) technology in the US. While hydrogen shows great promise, its adoption is hindered by high costs, limited availability of green hydrogen, and the need for significant infrastructure upgrades.

Energy costs pose an additional challenge. In traditional EAF steelmaking, energy accounts for 15-20% of production costs, but in new hydrogen-based DRI/EAF processes, this could rise to over 40%, rejecting the energy-intensive nature of hydrogen production.

Regulatory pressures, such as the EU's Carbon Border Adjustment Mechanism (CBAM), which comes into full effect in 2026, further complicate operations. While CBAM incentivizes decarbonization by protecting low-emission producers from cheaper high-carbon imports, it also pressures steel mills to accelerate investments in green technologies to stay competitive in a changing global market. Rising energy costs and potential supply chain bottlenecks add financial strain, requiring steelmakers to adopt more agile production and procurement strategies.

End users: The demand for decarbonized supply chains

Industries like automotive and construction face dual pressures to reduce carbon footprints while controlling costs. Green steel promises a lower emission alternative, but its premium – which adds an additional cost of 20-40% – remains a stumbling block for many end users.

The solution lies in strategic partnerships between steelmakers and end users, with long-term off-take agreements that balance costs while ensuring supply chain sustainability. Certification standards, still evolving, will become critical to verifying claims and aligning procurement decisions with climate goals.

Middle players: navigating complexity and uncertainty

For middle players such as traders, distributors, and service centres, the green steel transition adds layers of complexity. Managing inventories that include traditional, low-emission, and zero-carbon products introduces logistical challenges, while pricing volatility and regulatory compliance add further strain.

The EU's upcoming Waste Shipment Regulation, which limits scrap exports to non-Organisation for Economic Co-operation and Development (OECD) countries, will increase competition for high-quality feedstocks within the EU. Middle players must adapt to tighter supply conditions, rising prices, and shifting trade dynamics to maintain their roles in the value chain.

Raw material producers: rising demand for premium inputs

As steel production increasingly pivots to hydrogen-based and EAF technologies, raw material producers face growing demand for higher-quality inputs like DRI-grade iron ore and quality scrap. To meet this demand, these producers may need to innovate by developing methods to improve the quality of lower-grade ores or increase the efficiency of extraction processes. The EU's upcoming restrictions on scrap exports to non-OECD countries will further disrupt traditional supply chains. Scrap producers will need to adapt by enhancing the quality of their materials through better sorting technologies or exploring regional supply chains to comply with the regulations. Strengthening relationships with steelmakers and securing long term contracts will be key to ensuring a steady demand for premium materials as steel mills shift toward low-emission production.

Financiers: decoding risks and opportunities

Green steel projects require enormous capital investments, often without guaranteed returns in the short term. For nations this raises questions about risk and reward, particularly as regulatory environments evolve. Financial instruments like sustainability-linked loans and green bonds are increasingly critical, and their effectiveness depends on the availability of consistent benchmarks for green premiums. Financiers also face pressure to align with environmental, social and governance (ESG) goals, and the complexity of valuing decarbonization efforts presents both a challenge and an opportunity. Those who can effectively quantify and mitigate risks tied to green steel investments stand to play a pivotal role in enabling the sector's transformation.

The role of multi-stakeholder platforms

Collaborative initiatives are essential for navigating the complexities of green steel production. Multi-stakeholder efforts such as UNIDO's (United Nations Industrial Development Organisation) Industrial Deep Decarbonisation Initiative, and the Climate Group's Steel Zero, bring together policymakers, producers, and end users to align on decarbonization goals and drive systemic change. These platforms help stakeholders address overlapping challenges, from standardizing low-emission certifications to developing frameworks for sustainable supply chain finance. By fostering collective action, they reduce uncertainty and promote scalable solutions.

Navigating the challenges of today – trade tensions, and the just transition

The global push for decarbonization is colliding with escalating trade tensions. Tariffs on steel and its raw materials could undermine efforts to create open markets for green steel. The CBAM rollout might trigger friction with trading partners, with some viewing it as protectionist. But this challenge opens the door to regional collaborations. Agreements between climate-aligned countries could streamline trade for green steel, providing a much-needed competitive edge for low-emission producers. Decarbonization is as much about people as it is about technology. The shift to green steel production risks leaving traditional steelworkers behind, especially in regions dependent on emissions-intensive plants. Without investment in retraining and support, the transition could exacerbate inequality. Yet, the human dimension also presents an opportunity. Companies prioritizing a just transition will attract ESG-driven investors, build stakeholder trust, and gain a competitive edge by integrating social considerations into their business models.

The road to decarbonization in 2025 will be defined by

- The first zero-carbon steel production in Sweden, setting a global benchmark.
- The phased implementation of CBAM, reshaping trade flows and emissions accounting.
- The fine-tuning of international standards for low-emission steel, providing long-awaited clarity for buyers and sellers.
- Supply-chain disruptions in scrap and iron ore market markets, necessitating greater agility & foresight.
- Gradual energy sector transformation in Europe to feed new DRI capacities.

Navigating the transition

Reliable market intelligence will be critical for navigating this new frontier. Clarity of pricing across the entire steel value chain – from raw materials and semi-finished products to finished goods – provides a foundation for informed decision-making. With the right tools, insights, and collaborations, the steel value chain can transform the challenges of 2025 into pathways for growth and leadership in a decarbonized future

Mission Coking Coal

The Ministry of Coal has launched 'Mission Coking Coal' to enhance domestic coking coal production to reduce the import of coking coal, keeping in view the demand projection of the steel sector. This mission aims to increase domestic raw coking coal production up to 140 MT by FY 2029-30. The total domestic raw coking coal production during the financial year 2023-24 is 66.821 million tonnes (MT) while the domestic raw coking coal production target for the financial year 2024-25 is 77 MT. The target to increase raw coking coal production by FY2029-30 from CIL subsidiaries is about 105 MT by FY2029-30 from 60.43 MT during FY 2023-24. Modernization and renovation of existing ageing washeries of Bharat Coking Coal Limited (BCCL) and Central Coalfields Limited (CCL), which have surpassed the designed lifespan, for its optimal utilization to make more high-quality coal available in the country.

Supply of coal to the steel sector through the Non-Regulated Sector (NRS) Linkage auction route to promote domestic coking coal for steel production and implementation of reforms in the auction process with the aim of substitution of coking coal import are also being undertaken.

The Ministry of Coal has also auctioned 14 coking coal blocks to the private sector. These blocks are expected to start production by 2028-29.

India recorded its highest ever coal production of 997.826 million tonnes (MT) in the financial year 2023-24 which represents an 11.71 per cent increase in comparison to the corresponding figure of 893.191 MT in the year 2022-23, according to the year-end review of the Coal Ministry. During the calendar year 2024 (up to December 15, 2024), the country supplied about 963.11 MT of coal as compared to about 904.61 MT of coal during the same period of last year with a growth of about 6.47 per cent. This comprised a coal supply to the Power Sector of 792.958 MT as compared to 755.029 MT coal during the same period of last year with a growth of 5.02 per cent.

The coal supply to the non-regulated sector during the calendar year was 171.236 MT as compared to 149.573 MT during the same period of last year with a growth of 14.48 per cent.

Source: Weekly News, International Centre for Sustainable Carbon, 10 Jan. 2025

India's Crude Steel Production Capacity and Expansion Plans

- India's steel production capacity increased from around 137 million tonnes (mt) in 2018-19 to about 196 mt in 2023-24, a growth of 59 mt in just five years
- At present, India has 104.8 mt of installed crude steel production capacity in integrated steel plants. 21.3 mt of capacity is under execution
- In addition, secondary steel production capacity is around 91 million tonnes per annum
- Integrated plants have announced expansion plans for 85 mt.
- JSW Steel currently operates at a capacity of 33 mt and plans to increase it to 50 mt by 2030.
- Tata Steel may expand capacity at its steel mills by almost 20mn t to 40mn t/yr over the next 5 years.
- SAIL is expected to lift its production capacity by 15mn t to 35mn t/yr.
- Arcelor Mittal Nippon Steel India aims to lift steel capacity by almost 2.5 times to 24 m t/yr.
- JSPL may increase its steel producing capacity by 7.8mn t to 37mn t/ yr by 2030-31
- All ISPs together are targeting an additional 85 mt of capacity, which would elevate the total ISP capacity to 213 mt.

- When combined with the anticipated growth of secondary steel production, India’s total capacity is set to surpass 300 mt by the end of the decade.
- Crude steel production may increase to around 255 mt per year the 2030-31 financial year, from an estimated 143.6 mt in 2023-24.

Aluminium: Types, Characteristics, and Applications

Aluminium, the third most commonly found metal on our planet after silicon and oxygen **is a silvery-grey metal.** Aluminium was produced for the first time around 1824.

Pure aluminium does not occur in nature as it tends to bind with other metals easily. The most commonly found form is aluminium sulphates.

Aluminium **is a light metal** (density one-third of steel). When exposed to air, it forms a layer of oxide on its surface, due to its greater affinity toward oxygen, which leads to its common association with oxygen oxides, as a result, this is found mostly in the rocks in the crust.

The production of aluminium metal is primarily from bauxite ore which contains around 40% to 50% hydrated aluminium oxide mixed with silica and iron oxide. Melting point of aluminium is around 933.47 K.

Aluminium is a lightweight, strong, noncorrosive, flexible, and intently recyclable metal. It is preferred due to low density and flexibility which is used for aircraft components, window frames, ships, and high-rise buildings.

Aluminium alloys are generally highly ductile and malleable; hence they can be easily formed and machined.

Also has good electrical and thermal conductors, non-sparking, and non-magnetic properties.

It is highly recyclable material, requiring low re-melting energy, which is only around 5% of the energy needed to produce the primary metal. 75% of the material is recovered for reuse without losing its desirable properties.

Characteristics of Aluminium:

1. Lightweight

The specific weight of aluminium is 2.7 g/cm^3. Use of aluminium in automobiles reduces dead weight and energy consumption while increasing the load capacity. Also, the strength can be changed to adapt to the application by modifying composition of the alloys.

Aluminium-manganese-magnesium is the preferred mix for durability with strength while aluminium-magnesium-silicon alloy is preferred for automobile sheet metals.

2. Corrosion Resistance

A thin oxide coating is produced naturally by aluminium which acts as a protective film that prevents the metal from making much contact with the environment. This is useful for applications where it is exposed to corroding agents. However, aluminium alloys are much more corrosion-resistant than pure aluminium.

3. Electrical and Thermal Conductivity

Aluminium is an excellent conductor of heat and electricity. This has resulted in the first-choice preference of aluminium for power transmission lines. Also, an excellent heat sink can be used in appliances that require sudden and rapid heat drains.

4. Reflectivity

Aluminium is a good reflector of visible light along with heat. Its low weight in addition makes it an excellent material to be used for reflectors, for example, light fittings or roof blankets. Cool roofs reduce internal solar heat within the house, reflecting up to 95% sunlight.

5. Ductility

It has a low melting point and density. This allows it to be processed in several ways into a molten state.

The ductility of aluminium ensures the fluidity of design if the product is maintained. Sheets, foil, tubes, rods, and wires all are made due to ductile property of aluminium.

Types of Aluminium

To modify its properties such as formability, corrosion resistance, and machinability, pure aluminium is often combined with different elements. The alloys need to be identified and thus needed grading for identification.

The Aluminium Association created a grading system for identification of aluminium alloys and is responsible for maintaining the nomenclature of the standard grades. Aluminium alloys are graded according to the main alloying element along with its thermal and mechanical properties.

Aluminium alloys are classified mainly into two categories: **Wrought** and **Cast Aluminium**. Both categories have differently assigned designation systems.

Wrought Aluminium

Wrought is manufactured by melting aluminium ingots along with a certain amount of specific alloying element, which results in composition of the grade. The aluminium alloy is then cast and other mechanical processes. A four-digit number is used as a code to identify each grade. The first digit refers to the primary alloying element mixed with pure aluminium. The primary alloying element has major effects on the properties of the grades in a series. The second digit indicates modification of a specific alloy. The modifications require specific documentation and are registered with the IADS. If the designated number on the second digit is zero, the alloy is original/ unmodified. Third and fourth digits are numbers assigned to a specific alloy in the series. For example, in the 1000 series, these digits indicate purity of the alloy.

The following gives the series of wrought grades:

1000 Series

The 1000 series contain at least 99.0% aluminium with no significant alloying element. This series consists excellent corrosion resistance and high electrical and thermal conductivity. These are highly formable and work hardens very slowly due to their ductility and relative softness. Hence for processes requiring more deformation, they are preferred. They are weldable but have a very narrow melting range. However, the strength in these grades is comparatively lower.

Aluminium 1100 is the most common grade in 1000 series. It has the highest mechanical strength in 1000 series and is also known as pure commercial aluminium. This grade is suitable for heat sinks and heat exchange equipment due to good electrical and thermal conductivity. This grade also has excellent forming properties, thus making it suitable for cold working such as bending, roll forming, drawing, stamping, and spinning. Its ductility can be used to form wires, plates, foils, bars, and stripes. Along with cold working, hot forming is easily performed using this grade. Conventional welding methods can be used to weld this grade. However, high-pressure applications can be performed using this grade. This grade cannot be hardened by heat treatment and is only hardened by cold working, like most of the alloys in this series.

2000 Series

The 2000 series aluminium grades consist of around 0.7-6.8% of copper and smaller amounts of silicon, manganese, magnesium, and other elements. Copper is the primary alloying element for these grades. It imparts additional strength and hardness which helps to improve machinability. These grades can maintain high strength at a wide range of temperatures.

2000 series aluminium grades are suitable for aircraft and aerospace applications as these are high-performance and high-strength alloys. Addiction to copper decreases ductility and corrosion resistance. These are heat-treatable aluminium grades. Precipitation hardening is also performed to increase their strength with suitable heat treatment. However, these grades could be challenging to weld due to the inter-metallic compounds. Some of 2000 series grades are not suitable for arc welding as they are susceptible to hot cracking and stress corrosion cracking.

Aluminium 2011 is a free-machining alloy and has excellent machinability properties (i.e. can generate small chips and give a smoother surface finish), thus making it suitable for high-speed lathing process. Though this grade is a versatile alloy, it has poor corrosion resistance which needs to be coated or anodized. These are not recommended for forming and welding.

Aluminium 2024 is ideal for heavy-duty applications under stress for a long period. It is one of widely known high-strength aluminium alloys. This alloy has features such as good fracture resistance, fracture toughness, and low fracture crack growth. However, it requires it to be mitigated by cladding or anodizing to improve its poor corrosion resistance.

3000 Series

3000 series aluminium grades consist of manganese as the main alloying element, which comprises around 0.05-1.5% of the alloy. Manganese gives greater mechanical strength than pure aluminium, maintained at a wide range of temperatures. Characteristics include good corrosion resistance, high ductility along with formability. These are non-heat-treatable and are suitable for welding. Hardening can be obtained by a cold working process.

Aluminium 3003 contains 1.5% manganese and 0.1% copper, being the most widely used aluminium grade. This grade has same mechanical properties of Aluminium 1100 along with 20% higher tensile strength. This grade can be brazed, deep drawn, spun, and welded.

4000 Series

4000 series aluminium grades consist of 3.6-13.5% silicon as the primary alloying element, with small amounts of copper and magnesium. Silicon lowers the alloy's melting point and helps in improving fluidity during the molten state. 4000 series grades are a suitable option as a good filler material for welding and brazing. Heat treatability of some grades under the 4000 series is dependent on the amounts of copper and magnesium in the alloy. The addition of such elements gives a favourable response to heat treatment. The heat-treated grades can be preferred for welding.

5000 Series

5000 series aluminium grades contain 0.5-5.5% magnesium as the main alloying element. The grades in the series cannot be heat-treated and can be hardened by cold working. They have high ductility in annealed conditions and moderate strength. These can be welded easily and have high corrosion resistance. Moreover, these are excellent alkaline resistant. Some grades in this series contain 3.5% magnesium which is not suitable for high-temperature applications, as they are prone to stress corrosion.

Aluminium 5005 is generally used in sheet metal work. Features include good formability and are easy to bend, spin, draw, stamp, and roll form. These can withstand marine environments and are corrosion-resistant.

Aluminium 5083 contains some amounts of manganese and chromium. It can provide resistance to most industrial chemicals and seawater. It can retain its high strength after the welding process.

Aluminium 5052 offers better resistance to marine environments compared to other grades. It exhibits good finishing qualities and can be drawn and formed into intricate shapes due to its excellent workability. It has the highest strength among the non-heat-treatable aluminium grades.

6000 Series

6000 series aluminium grades consist of silicon and magnesium as major alloying elements. The presence of silicon and magnesium is 0.2 - 1.8% and 0.35 - 1.5%, respectively. To increase their yield strength, these grades can be heat-treated. The presence of high silicon content promotes precipitation hardening, which can result in reduced ductility. However, this effect can be reversed with addition of chromium and manganese, which can depress recrystallization. It is difficult to weld these grades because of their sensitivity to solidification cracking, thus proper welding techniques should be applied.

Aluminium 6061 is the most versatile among the heat-treatable aluminium alloys. It is also known as the “work-horse” alloy. Its characteristics include excellent formability and corrosion resistance (using bending, deep drawing, and stamping). These are suitable for welding and can be welded using any method.

Aluminium 6063 is an alloy commonly used for aluminium extrusion. It has high tensile strength and corrosion resistance along with excellent finishing qualities. It can produce smooth surfaces after forming intricate shapes, hence making it suitable for anodizing. Other characteristics include good weldability and machinability.

Aluminium 6262 is a free-machining alloy. These have excellent mechanical strength and good corrosion resistance.

7000 Series

7000 series aluminium grades consist of 0.8-8.2% zinc as the main alloying element. Alloys with the highest strength are present in this series. These are heat-treatable grades that need to be followed by aging to increase their yield strength.

Presence of zinc leads to precipitation of $MgZn_2$ and $Mg_3Zn_3Al_2$. As a result, the intermetallic compounds harden the alloy.

Characteristics include high corrosion resistance, which can be enhanced by the addition of copper. The grades in this series have poor weldability as these are susceptible to stress corrosion cracking and hot cracking.

Aluminium 7075 has among the highest strengths among the aluminium grades. It is a high-performance alloy, with a higher tensile strength than Aluminium 6061. This alloy is harder and can withstand prolonged periods of stress. It is weldable using spot or fuse methods.

Cast Aluminium

As the name suggests, cast aluminium is produced by casting process, involving pouring molten aluminium together with specific amounts of alloying elements. It is then moulded to form the desired shape of the alloy. Cast aluminium alloys generally have lower tensile strength as compared to wrought aluminium. They are susceptible to cracking and shrinkage. However, they are more cost-effective. Molten aluminium can flexibly take the shape of the mould cavities, as a result, these alloys can be moulded into a wide range of shapes.

A four-digit code which also includes a decimal value is assigned to identify each cast aluminium grade:

- The first digit is assigned to indicate the primary alloying element in the alloy.
- The second and third digits are arbitrary numbers, except for the 1XX.X series. These digits in the 1XX.X series indicate the purity of the pure aluminium alloy.
- The last digit indicates whether the alloy is a cast or an ingot. These are represented by (".0") and (".1" or ".2").

1XX.X Series

1XX.X series has the maximum amount of pure aluminium (99.00% minimum). These aluminium grades have high electrical and thermal conductivity, good reliability along with excellent corrosion resistance and finishing properties.

2XX.X Series

The 2XX.X series consists of copper as the primary alloying element. These aluminium grades are heat-treatable. Characteristics include high strength and low fluidity. These also have low corrosion resistance and ductility. Moreover, these are susceptible to hot cracking.

3XX.X Series

The 3XX.X series contain silicon as the primary alloying element along with small amounts of magnesium and/or copper. These aluminium grades are heat-treatable. Significant characteristics include high strength and good wear and cracking resistance. The increased amount of copper helps the grade be less resistant to corrosion. However, the ductility is comparatively low.

4XX.X Series

4XX.X series grades consist of silicon as main alloying element. These have moderate strength. These are non-heat treatable and also have good machinability due to their high ductility. Significant characteristics include good impact resistance, corrosion resistance along with casting properties.

5XX.X Series

5XX.X series aluminium grades consist of magnesium as primary alloying element. Presence of magnesium makes these corrosion-resistant. However, these are non-heat-treatable. Significant characteristics include good corrosion resistance and a very attractive appearance when anodized. The strength is moderate-to-high & are machinable with excellent casting properties.

7XX.X Series

7XX.X series contain zinc as primary alloying element. These are heat-treatable grades. Significant characteristics include high strength, good corrosion resistance, good dimensional stability, and good finishing qualities. However, the casting properties of this alloy are poor.

8XX.X Series

8XX.X series contain tin as the primary alloying element. These are non-heat-treatable alloys. Characteristics are good machinability and wear resistance due to low coefficient of friction. But mechanical strength is comparatively low.

The series 6XX.X is not used in these standards.

Temper Designation of Aluminium Alloys

The temper designation system is designed to designate the response of a certain alloy to welding and other fabrication processes. It is related to the strengthening and hardening processes the alloys have undergone. This destination system is used by both wrought and cast aluminium alloys.

The temper designation system of an aluminium alloy comprises a capital letter which is followed by a two-digit number for strain-hardened and thermally treated alloys. It is separated from the alloy numbering designation by using a hyphen (e.g., 5052-H32).

The first character in temper designation is used to indicate the main treatment that the alloy has undergone.

Letter	**Treatment**
F	As fabricated alloys, no treatment was performed
O	Annealed
H	Strain-hardened or cold-worked
W	Solution heat-treated
T	Thermally treated

The first and second digits are used to indicate the operation after strain hardening and the degree of strain hardening respectively (for strain-hardened alloys).

The first digit indicates the thermal treatment condition for thermally treated alloys.

Applications of Aluminium

Wrought aluminium grades

Aluminium 1100 is used in rivets, deep-drawn parts (e.g., pots, kitchen sinks), railroad tank cars, and reflectors. They are used in stocks, heat exchangers, and heat sinks due to their high thermal conductivity. Moreover, this grade is suitable for electrical applications.

Aluminium 2011 is used for manufacturing machine and automotive parts, fasteners, weapons, munitions, pipe and tube fittings, and atomizer parts. It is also applied to make screw machine products.

Aluminium 2024 is the most suitable aluminum grade for aircraft and aerospace applications. It is also extensively used in marine equipment, wing tension members, bolts, hydraulic valve parts, shafts, couplings, nuts, gears, and pistons.

Aluminium 3003 is used in the production of heat exchangers, pressure vessels, storage tanks, and fuel tanks. It can also be utilized in food-handling instruments such as cooking utensils, pots, ice cube traps, pans, and refrigerator panels. It is also employed in manufacturing construction products such as roofs, sidings, garage doors, insulation panels, gutters, and downspouts.

Aluminium 5005 makes an excellent construction material and is used in sidings, roofing, and furniture and as an electric conductor. Moreover, It is also utilized in chemical and food handling equipment, HVAC equipment, vessels, tanks, and high-strength foils. Due to its bright surface, it is helpful in decorative applications.

Aluminium 5083 is used in rail cars, pressure vessels, drilling rigs, shipbuilding, and vehicles.

Aluminium 5052 is used in ductile applications such as food processing equipment, cooking utensils, heat exchangers, and chemical storage tanks. Its application also includes truck panels, flooring panels, rivets, wires, tread plates, and containers.

Aluminium 6061 can be shaped into tubes, beams, and angles with rounded corners. They are used in tank fittings, trucks, railroad cars, marine components, pipelines, and furniture.

Aluminium 6063 is extensively used in architectural applications such as stair rails, furniture, window frames, doors, and sign frames. They can also be shaped into tubes, angles, beams, and channels.

Aluminium 6262 is used in screw machine products, hinge pins, marine fittings, pipeline fittings, knobs, nuts, couplings, valves, and decorative hardware.

Aluminium 7075 is preferably employed in aerospace and aircraft applications due to its high strength. It can also be used in producing engine parts , molds, competitive sporting equipment, and industrial tooling.

Forms of Aluminium

1. Wires

Aluminium wires are produced by processing the aluminium ingots through a die that compresses the diameter of the ingot while increasing its length.

Aluminium has good electrical conductivity and a high strength-to-weight ratio, therefore it is used as an alternative to copper in electrical applications. However, aluminium wires can be oxidized easily. If the measures to prevent oxidation of wires are not taken, it can result in the deterioration of the electrical wiring and a potential fire hazard.

2. Foils

Aluminium foils are manufactured using aluminium sheets. It undergoes a flattening process using a roll mill which reduces the thickness of aluminium sheets.

The range of thickness of aluminium foils is 0.2 mm to 6 microns. These are malleable, pliable, and can be easily bent and wrapped around objects.

They are also utilized as a packaging and electromagnetic shielding material along with other industrial applications.

3. Sheets

Aluminium sheets are produced by applying high-pressure rolling operation on aluminium slabs several times until they are thinner and flatter.

The aluminium sheets have a thickness of under 0.249 inches.

These are the most extensively used form of aluminium products. The application of aluminium sheets is to manufacture cans, packaging materials, truck, and automotive parts, cookware, and construction parts such as roofing, siding, and gutters.

4. Plates

Aluminium plates are manufactured just like aluminium sheets, the only difference is that the thickness is above 0.250 inches.

As a result, they are more often used in heavy-duty applications. Applications of aluminium plates are in transportation, aerospace, aircraft, marine, and military industries. They are also utilized to manufacture storage tanks and fuel tanks.

5. Bars, Tubes, and Pipes

Aluminium bars, tubes, and pipes are extremely important components manufactured using Aluminium. These are produced by extrusion process.

The die transforms the shape of the billet as it passes through.

The shapes produced can be round, rectangular, square, and hexagonal bars, as well as hollow tubes and pipes.

Source: The Mechanical Engineering.com

Canada Wants G-7 talks on Metals Pricing to Counter China's Sway

Canada wants its allies to explore a pricing floor for critical minerals to address what it views as market interference from China, the dominant supplier of metals key to the energy transition. Canada has been thinking about supporting investment through measures, such as pricing floors, to address alleged market manipulation. Such measures should factor in an accounting of environmental and labor standards associated with production.

Numero-uno Player

China dominates mineral production and processing essential for EVs, batteries, solar panels and military tech. This has pushed the US and allies to seek alternatives and consider policies to reduce reliance on China.

Canada wants to work with other Group of Seven Nations to make pricing support initiatives a possible “centerpiece” of discussions when Canada hosts the G-7 Summit in June. This could be expanded to other nations like Australia. Nickel dumping has caused “enormous problems for Australia.

To build mines and secure resources, investors will need “some degree of certainty that the products that they’re actually producing are going to have value at the end of it. If China can simply intervene and crater the price, other nations will never see the development of the critical minerals that they have to.

Source: Bloomberg 17th January 2025

2024 Global Crude Steel Production

	December 2024 (million tonnes)	% change Dec-24/23	Jan - Dec 2024 (million tonnes)	% change Jan - Dec 24/23
Africa	1.9	-1.0	22.3	1.0
Asia and Oceania	106.3	9.0	1.357.8	-1.0
EU (27)	9.6	7.2	129.5	2.6
Europe, Other	3.3	-14.3	43.2	3.4
Middle East	4.6	-4.5	54.1	0.5
North America	8.8	-4.3	105.9	-4.2
Russia & other CIS + Ukraine	6.8	-6.8	84.8	-4.2
South America	3.1	-3.8	41.9	0.6
Total 71 countries	**144.5**	**5.6**	**1.839.4**	**-0.9**

Crude Steel Production by Region

The 71 countries included in this table accounted for approximately 98% of total world crude steel production in 2023. Regions and countries covered by the table:

- Africa: Algeria, Egypt, Libya, Morocco, South Africa, Tunisia
- Asia and Oceania: Australia, China, India, Japan, Mongolia, New Zealand, Pakistan, South Korea, Taiwan (China), Thailand, Viet Nam
- European Union (27) Austria, Belgium, Bulgaria, Croatia, Czechia, Finland, France, Germany, Greece, Hungary, Italy, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden
- Europe, Other: Macedonia, Norway, Serbia, Türkiye, United Kingdom
- Middle East: Bahrain, Iran, Iraq, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, Yemen

- North America: Canada, Cuba, El Salvador, Guatemala, Mexico, United States
- Russia & other CIS + Ukraine: Belarus, Kazakhstan, Russia, Ukraine
- South America: Argentina, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela

2024 Global Crude Steel Production Totals

Total world crude steel production was 1,882.6 Mt in 2024.

Rank		2024	2023	%2024/2023
1	China	1 005.1	1 022.5	-1.7
2	India	149.6	140.8	6.3
3	Japan	84.0	87.0	-3.4
4	United States	79.5	81.4	-2.4
5	Russia (e)	70.7	76.0	-7.0
6	South Korea	63.5	66.7	-4.7
7	Germany	37.2	35.4	5.2
8	Türkiye	36.9	33.7	9.4
9	Brazil	33.7	32.0	5.3
10	Iran	31.0	30.7	0.8
11	Viet Nam (e)	22.1	19.2	14.9
12	Italy	20.0	21.1	-5.0
13	Taiwan, China (e)	19.1	19.1	-0.3
14	Indonesia (e)	17.0	16.8	0.9
15	Mexico (e)	13.7	16.4	-16.5
16	Canada (e)	12.2	12.2	0.1
17	Spain	11.8	11.4	3.3
18	France	10.8	10.0	7.6
19	Egypt	10.7	10.4	3.6
20	Saudi Arabia	9.6	9.9	-3.4
21	Malaysia (e)	8.8	7.5	16.9
22	Ukraine	7.6	6.2	21.6
23	Austria	7.1	7.1	0.0
24	Belgium (e)	7.1	5.9	21.1
25	Poland (e)	7.1	6.4	10.1
26	Netherlands	6.4	4.7	36.1
27	Thailand (e)	4.9	5.0	-1.0
28	Australia	4.8	5.5	-11.9
29	South Africa	4.7	5.0	-4.8
30	Algeria	4.5	4.4	2.2
31	Bangladesh (e)	4.5	5.0	-10.0
32	Kazakhstan	4.2	3.9	6.5
33	Pakistan (e)	4.1	5.3	-23.2
34	Sweden	4.0	4.3	-5.5
35	United Kingdom	4.0	5.6	-29.0
36	Slovakia	3.9	4.4	-11.7
37	Argentina	3.9	4.9	-21.6
38	United Arab Emirates	3.7	3.8	-1.4
39	Finland	3.7	3.8	-3.8
40	Oman	3.0	2.9	4.5
	Others	42.5	43.6	-2.5
	World	**1 882.6**	**1 897.9**	**- 0.8**

Top 10 Steel Producing Countries

Countries	December 2024 (million tonnes)	% change Dec-24/23	Jan - Dec 2024 (million tonnes)	% change Jan - Dec 24/23
China	76.0	11.8	1.005.1	-1.7
India	13.6	9.5	149.6	6.3
Japan	6.9	-1.1	84.0	-3.4
United States	6.7	-2.4	79.5	-2.4
Russia	5.7 e	-8.6	70.7	-7.0
South Korea	5.2	-3.2	63.5	-4.7
Germany	2.7	4.1	37.2	5.2
Türkiye	3.0	-7.6	36.9	9.4
Brazil	2.6	1.8	33.7	5.3
Iran	2.6	-8.2	31.0	0.8

e - estimated. Ranking of top 10 producing countries is based on year-to-date aggregate

Indian Steel Industry: Yesterday, Today and Tomorrow

Contributed by
Shri S C Suri,
Past Chairman, IIM Delhi Chapter

Steel Industry Yesterday

The Steel Industry in India has come a long way since Independence when there were only three steel plants namely TISCO, IISCO and VISL. These plants were producing steel of about 1.2 Mt in 1948.

After Independence Govt. decided to set up steel plants at Rourkela, Bhilai, Durgapur, and Bokaro in late Fifties and early Sixties. Subsequently Alloy Steels Plant at Durgapur and Salem Steel Plant were also set up. Vizag Steel plant came up in nineties. Many EAF and IF based mini steel plants were installed by private entrepreneurs in seventies and eighties.

Post liberalization private sector players also entered the steel sector for setting up both midi and integrated steel plants.

In 2002-03 the steel capacity of India was around 33 Mt.

Steel Sector Today

Today the steel capacity of India is around 179 Mt and per capita consumption of steel is about 98 kg. A number of technological interventions have taken place in Indian Steel Sector. These are helping steel industry to improve on the technoeconomic parameters in terms of improvements in energy efficiency, raw materials utilization, coke rate, blast furnace productivity, steel quality and cleanliness, Application of information technology, automation and digitalization in steel industry are changing the way steel is made.

Steel Industry Tomorrow

Future Expansion in Steel Sector

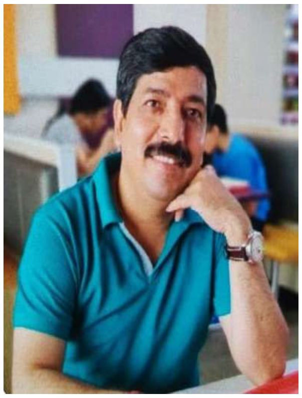
Future expansion in steel sector will cater to strategic materials needed to improve economy and productivity in the MSMEs, energy sector etc. with improved technological knowledge.

Following is some of the key areas on which developmental work is being undertaken:

- The module size for the new steel plants is 6 million tonnes.
- Coal washeries are being established to upgrade the quality of Indian coking coal.
- The emphasis on increasing the size of blast furnace. Blast Furnaces of 5800 m^3 capacity are already operating at Kalinga Nagar plant of tata Steel.
- There is emphasis on use of lighter steel products with high mechanical strength.
- In alloy steels making alloys additions are being made in the ladle furnace, hence no wastage of alloys in steel making process. There is no wastage of alloys in the slag.
- The nickel resources are very meagre and their concentration is also very limited. Ferritic Stainless Steel is becoming more popular by users.
- Colour coated products are being increasingly produced by Indian steel industry.
- The technology of dry quenching of coal has been very well-established resulting in energy saving.
- Stamp charging of coal has been adopted in Indian steel plants resulting in high quality of coke with the use of inferior coal in the blend.

- Steel plants are being established near raw material base.
- Energy efficiency in production of steel is the need of the hour.
- Use of renewable energy instead of fossil fuel needs to be attended.
- Use of hydrogen is being attempted in the blast furnaces in a limited way. This technology has to be perfected.
- The alumina silica ratio in Indian iron ore is adverse. Washing of Indian ore results in removal of silica instead of alumina.
- It is anticipated that crude steel production capacity will grow to about 300 million tonnes in next 5 - 6 years.
- New technologies are being perfected to increase the productivity of Indian steel plants.
- Technology of making CRGO steel should be thought of.
- There is a need for development of strategic steel products for Defence Sector as this sector is growing rapidly and also for automobiles.
- Steel sector is availing PLI scheme for developing steel products which were hitherto being imported.
- Thrust needs to be given to development of composites which make the steel lighter with properties of high load bearing capacity. It is expected that Indian steel sector will play a pivotal role in the growth of India economy and will promote strong base for the growth of India.

Know Your Members



Shri Neeraj Nautiyal

Academics:

B. E. (Industrial and Production Engineering) from Jawahar Lal Nehru College of Engineering (1995); M. E. (Industrial Metallurgy), IIT Roorkee (1999); Executive MBA (International Marketing), NIBM Chennai; EMDP on Leadership Transformation from XLRI Jamshedpur; Project Management Diploma, Alison, Ireland (2021), Certificate Course on Successful Negotiation: Essential Strategies & Skill, University of Michigan, USA (2021)

Experience and Expertise

Shri Neeraj Nautiyal with 28 years of rich experience in steel Industry is presently working at Yogiji Digi Private Limited, Faridabad. as Sr. VP. His major roles are projects, developing strategies for product development, assisting in project execution, latest technology for process, green steel production and business development in Cold Rolling Mills, Metal Coating Process Line and ARP with national and International customer base.

He started his steel Career at Tata Steel Ltd (BSL, Sahibabad) as Trainee Engineer on 6-Hi Cold Rolling, 1670 mm wide Mill (Hitachi, Japan) for CRCA Complex, specialised for Auto Body Panel , in technical collaboration with Sumitomo Japan.

Also worked in Integrated Steel Plant {JSW BPSL (Formerly BPSL)}, Jharsuguda (3.5 MTPA) with a facility of 10 numbers of Rotary Sponge Iron Klin, 2.1 MTPA CSP from SMS Germany, 0.6 MTPA Wire Rod and Bar Mill from Danieli Italy , 1018 m^3 BF from SSIT China and 2015 m^3 BF from PW, Italy with 1MTPA CRM Complex and 0.65 MTPA Coating Division (GI , GL and CCL) during 2003 - 2010 and 2011 - 2021 .He also worked at JSW Rajpura (formerly VIL) for Green Field Tinning Line Project .Also executed Aarti Group CRM Complex Green Field Projects (Ethiopia , Nigeria and Nepal) .

Mr Neeraj Nautiyal also developed Austenitic Valve Steel, SS316 L for M/s Star Wire Ltd. for first time in the Country. Under his able leadership 400,000 TPA CRM and Coating Division at Shyam SEL & Energy Ltd. Phase I was also implemented.

Mr. Nautiyal is a Life Member of The Indian Institute of Metals

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