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(FORMERLY KNOWN AS ALL INDIA INDUCTION FURNACES ASSOCIATION)

(Promoting Sustainability in Steel for Greener Future)

AIIFA News

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What's Inside

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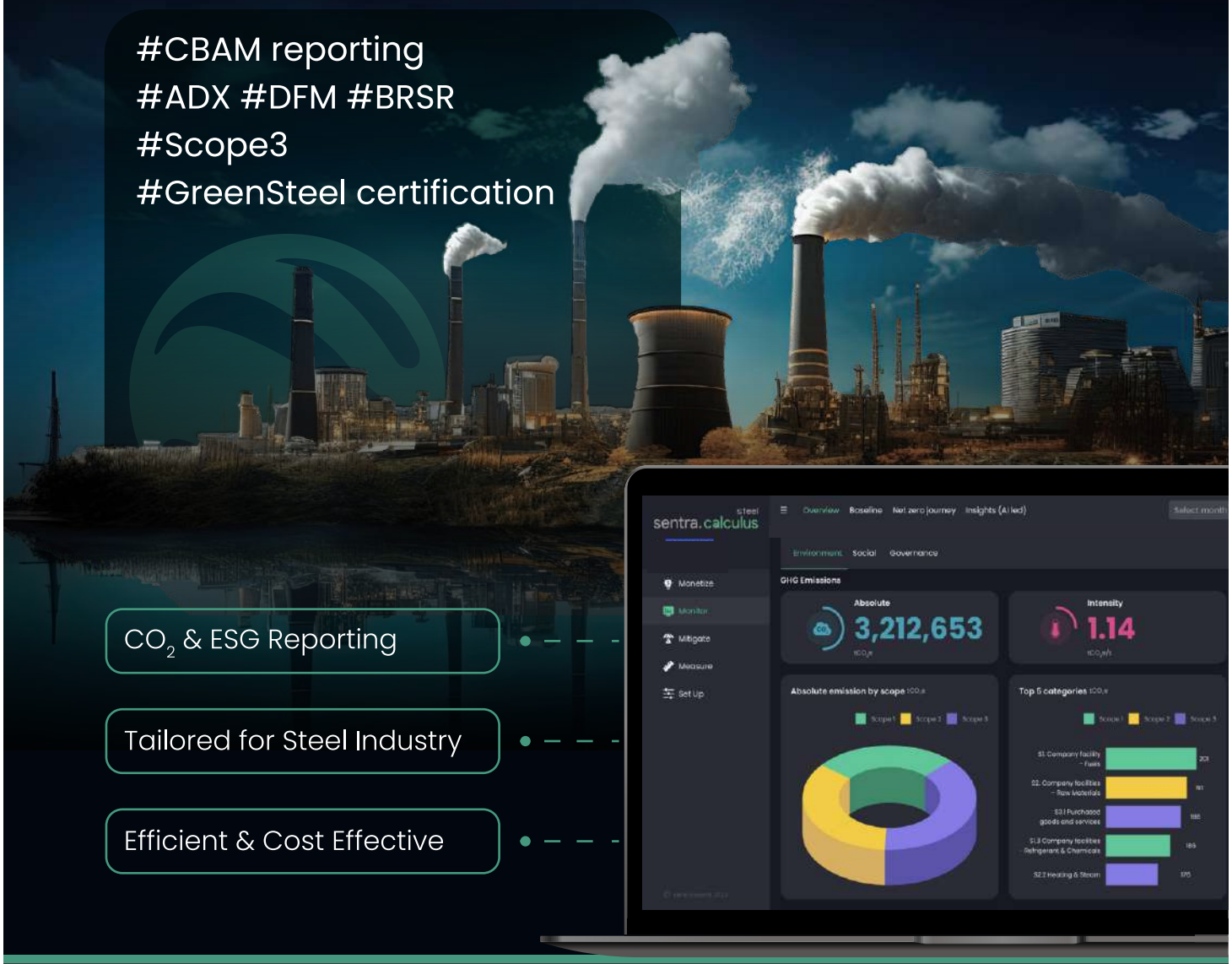

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- Cable Reeling Drum
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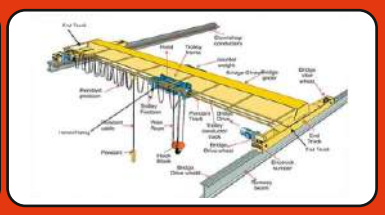

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- Spare Parts & Accessories of EOT Cranes
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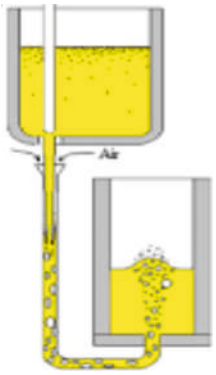
EX ASP/SAIL, AIIFA CONSULTANT

LIQUID STEEL OF INDIAN INDUCTION FURNACE CASTING ROUTE

Introduction: Today, more than 90% of liquid steel globally produced as semi-finished products by continuously casting and .rest about 30% in the form of ingot which are manufactured as rolled products and forging. But cast ingots are mostly used by forging industries. Ingot casting production is increasingly concentrated on alloy & special steels mostly critical grades where all of the typical quality issues associated which are strictly followed. Steel ingots are also rolled.

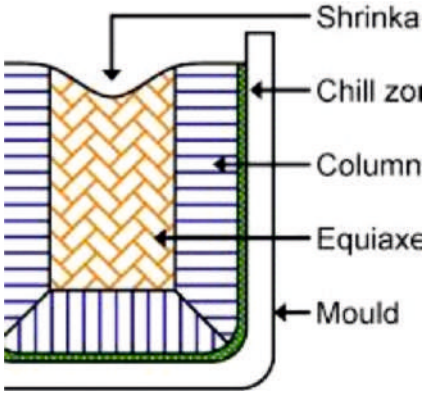
The present-day' popular and cost-effective process route for producing long products consuming by construction, engineering and various manufacturing industries are manufactured by continuous casting of bloom/ billet and hot rolling the same in rolling mills as long products in different shapes of bar, flat plate/ sheet and sectional products.. The cast billet/ bloom or rounds are fed substantially without subsequent heating directly to a roll train. This makes the design of the plant more simple with cost effective ad easy operation improving productivity, quality lowering production cost.

Ingot Casting: Ingot casting is a conventional casting process for liquid steel. Production of crude steel through the ingot casting route constitutes a very small percentage of global crude steel production. However, the method of casting of the liquid steel in ingot moulds is still fundamental for specific low-alloy steel grades and for special forging applications, where products of large dimension, high quality or small lot size are needed. Typical application for conventional ingot casting includes the power engineering industry (e.g. shafts for power generation plants, turbine blades), the oil and gas industry (conveying equipment, seamless tubes), the aerospace industry (shafts, turbines, engine parts), ship building (shafts for engines and drives), tool making and mechanical engineering (heavy forgings, cold, hot and high-speed steels, bearing, drive gears) as well as automotive engineering (shafts, axes).



1Ingot Teeming

As the demand of heavy ingot increases nowadays, especially from the power engineering industry and ship industry, there is a tendency of producing extreme large ingots over 600 t and continuous cast strands with thickness over 450 mm and rounds with diameter up to 800 mm, which are mainly applied for pressure retaining components such as reaction vessels for nuclear power plant and rotating components like drive shafts of gas turbines and generator rotors etc..



Cast Structure

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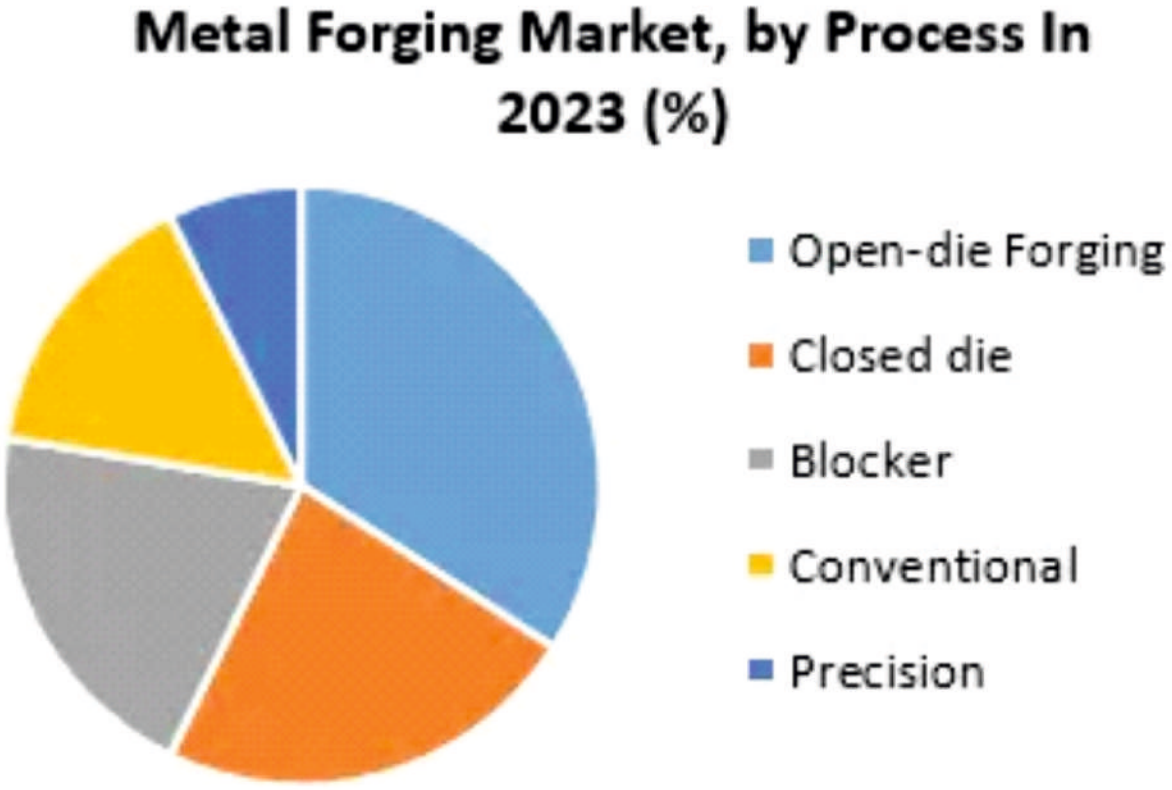
LIQUID STEEL OF INDIAN INDUCTION FURNACE CASTING ROUTE

Ingot solidification is the step in ingot casting when the melted metal that has been placed into a mold starts to solidify. This turns the melted metal into a hard object that is then later hot rolled into the desired shape of the ingot, such as a square slab.

Steel ingots for steel rolling mills and forgings are generally made by casting liquid steel into cast-iron ingot molds. The liquid steel either falls into the ingot mold or is introduced at the lower end termed bottom pouring and rises up the mold. The mass of the ingot mold is selected so that a major part of the melting is led away into the ingot mold made of cast iron. Thermal coefficient of cast iron is lower than that of steel. Because of this property, liquid steel on solidification contracts more than cast iron which makes detachment of ingot easier from the mold. Inner walls of the mold inside of which are coated by either tar or fine carbon. The coated material decomposes during solidification and prevents sticking of solidified ingots with the inner walls of the mold.

Material used for the production of cast iron molds is generally grey cast iron with lamellar graphite. The typical composition of grey cast iron is C – 3.3 % to 4.0 %, Mn – 0.4 % to 0.9 %, Si – 1.2 % to 2.2 %, P – 0.2 % maximum, and S – 0.05 % maximum. Ductile cast iron or treated pig iron can also be used in the production of molds.



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LIQUID STEEL OF INDIAN INDUCTION FURNACE CASTING ROUTE

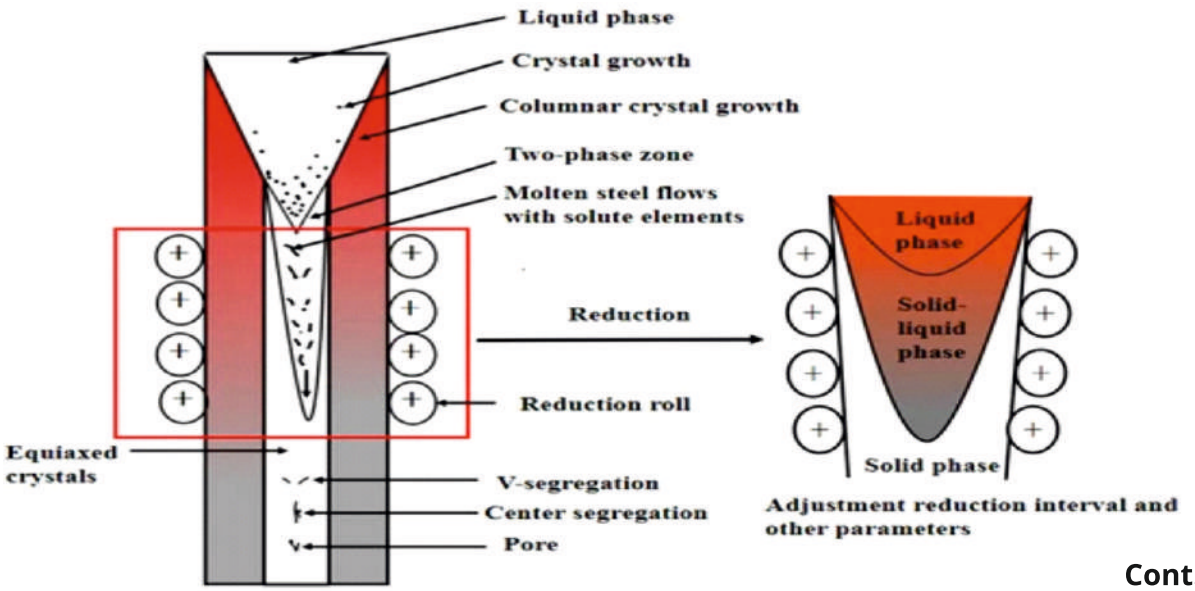
Global Metal Forged (Mainly Steel Items)

Steel ingots produced in these small section molds are known as pencil ingots. Typically steel ingot used for the production of rolled products has weight in the range of 5 tons to 35 tons. Pencil ingots are used for the rolling of merchant long products and reinforcement bars and has a weight typically in the range of 100 kg to 200 kg. Steel ingots used for the production by forging of the heavy equipment/components can be extremely large ingots..

After Ingot teeming, the mold cooling effect creates an advancing solidification front, which has several associated zones, closer to the mold wall there is a solid zone that draws heat from the solidifying melt, for alloys. there may exist a "mushy" zone, which is the result of solid-liquid equilibrium regions in the alloy's phase diagram, Ingot casting, followed by forging ,in either in press or hammer is the only route available for the production for quality. Ingot casting is the process of creating ingots out of metals. The metal is melted and refined and then poured into a mold. The metal then solidifies, forming the ingot, at which time the mold is removed and the ingot is soaked in heating pits.

The molds employed for the casting of steel ingots have a square, rectangular, round, or polygonal cross-section, in which liquid steel solidifies into a desired shape to be processed by rolling or forging. Ingots with square cross section are used for rolling into bloom/ billets, rails and other structural sections, whereas, ingots with rectangular cross section, are used for rolling into flat products. Round ingots are used for tube making. Polygonal ingots are used to produce tyres, wheels, etc. Low capacity steel melting shops with induction furnaces uses very small cross section ingots molds for casting of liquid steels.

Continuous Casting: The continuous casting occupies a pivotal position in the steel industry to improve the efficiency and accuracy in determining the processing parameters. According to the continuous casting case, the object-oriented method is applied to express the continuous casting cases. Demand of rolled product as bar or structurals is high enough in grades AISI 4130/40, 4330/4340, 52100 etc.



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LIQUID STEEL OF INDIAN INDUCTION FURNACE CASTING ROUTE

Concast Process of Shaping Liquid Steel

The Melting and Refining process for Shree TMT (Major Concast Product) involves several steps that effectively transform raw materials into exceptionally robust and high-quality TMT steel bars, which serve as the fundamental building blocks for constructing solid infrastructures.
To assure the production of outstanding TMT steel bars, Equipment and Process-.

Raw Material Selection

Induction Furnace: The raw materials are charged into in-house induction furnaces. Once the raw material has been melted inside the furnace, the molten metal is separated from the slag.

Purging and Refining: The molten metal is purged within the ladle furnace before various refining to remove any leftover impurities. These agents and other chemicals aid in achieving the required chemical composition and improving steel quality. During the rolling process, the chemical composition is crucial for achieving weldability, ductility, strength, and elongation. The advanced spectrometer accurately measures the chemical composition of steel, to ensure that TMT bars meet the highest industry specifications.

Continuous casting is an integral part of the TMT bar manufacturing process. The casting process to solidify a molten metal mix by casting a predetermined length of metal. To keep up with the hardening process, new molten metal is continuously and precisely fed to the mold. The solidifying billets enter a secondary cooling chamber to achieve complete solidification, the semi-finished billets are sprayed with water by critical technique for keeping the shape of the solidified billets and enhancing their quality in the long run.. After the steel rebars leave the finishing mill at the desired size, they enter a water-cooling chamber where they are quenched and self-tempering technology.. However, TMT production is highly flexible where ribbed TMT bars are excellent for premium-grade infrastructure. This treatment is carried out in three stages:

• Immediately after the steel rebars leave the last mill stand, they are rapidly cooled to which ensure surface hardening.
• After the quenching operation is completed, the surface layer of each bar is tempered using the residual heat remaining in its core of product.
• The third stage occurs when the steel bars are placed on a cooling bed and subjected to rapid air cooling.

The extensive, meticulous process combined with cutting-edge surface treatment technology, our TMT bars embody exceptional strength, ductility, bendability, and weldability, fortified by remarkable resistance against age-induced corrosion. Chemical composition and homogeneity of the steel bars are certified by producers complying standards using in-house facilities. The quality of TMT (Thermo-Mechanically Treated) bars is crucial in construction for several reasons:

Cont...

LIQUID STEEL OF INDIAN INDUCTION FURNACE CASTING ROUTE

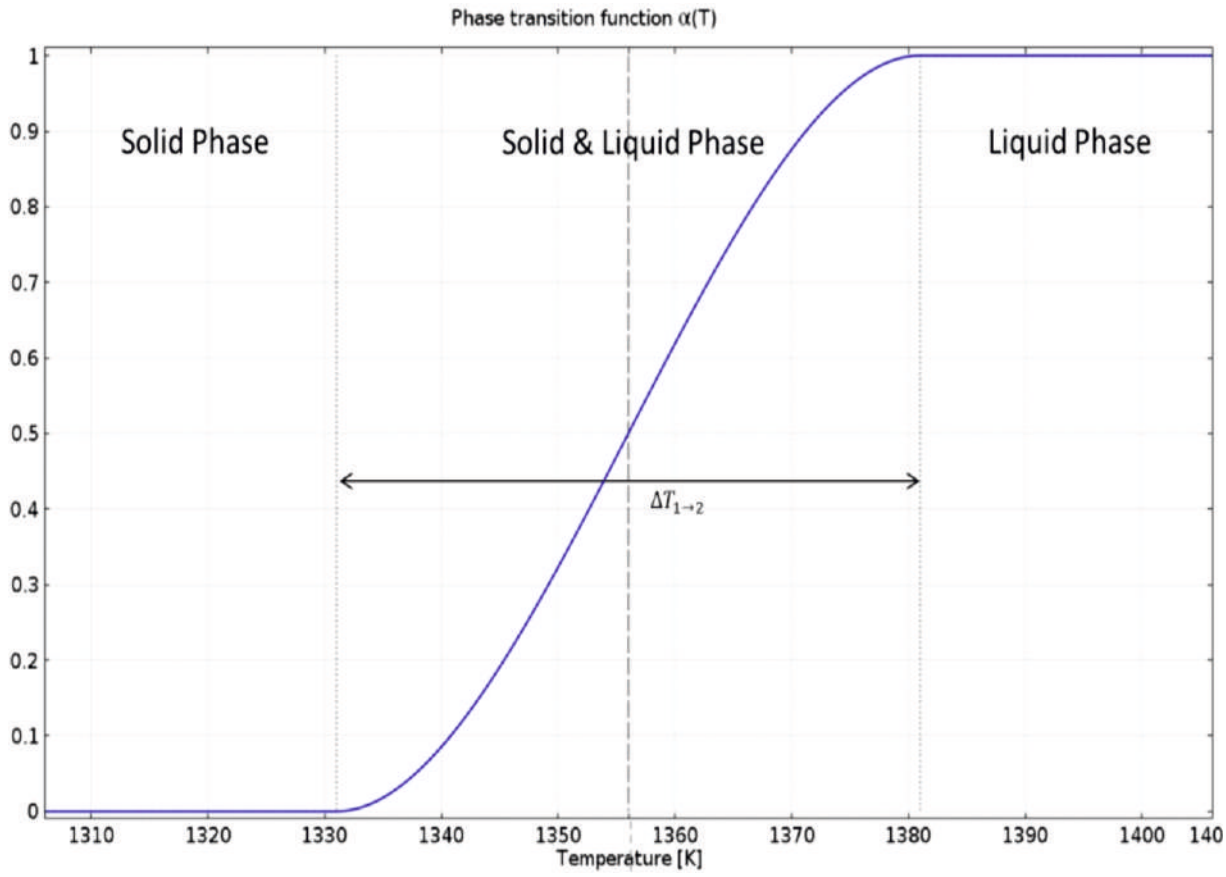
• **Structural Integrity:** TMT bars play a critical role in providing strength and structural integrity to concrete structures. They act as reinforcement, withstanding tensile forces and preventing cracks or failure in the structure.

• **Load-Bearing Capacity:** The quality and strength of TMT bars directly influence the load-bearing capacity of the structure. Inferior quality bars may not have the necessary strength to support the required loads, leading to structural failure or compromised safety.

• **Durability and Longevity:** Construction projects are intended to last for many years, and the durability of the structure is essential. High-quality TMT bars are designed to resist corrosion, rusting, and degradation over time.

• **Weldability and Compatibility:** High-quality TMT bars have good weldability, ensuring secure connections and maintaining the structural integrity of the building

Common Casting Defects.- Joint Flash or Fins, Cavities, Blow Holes, Pin Holes, Discontinuities, Flow Marks, ,Incomplete Casting, Incorrect Shape or Dimension, Inclusion/ Structural Anomalities. These all will be eliminated by following Standard Operating Practice.



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LIQUID STEEL OF INDIAN INDUCTION FURNACE CASTING ROUTE

Phase Changes During Reduction from liquid steel to solid in CC

In con-cast products, common surface defects may arise as longitudinal mid face and corner cracks, transverse mid face, corner cracks, and deep oscillation marks. Internal defects can be midway cracks, triple point cracks, centre line cracks, diagonal cracks, centre segregation and porosity, casting flux inclusion, and blow holes

Casting is carried out with proper tundish flux through an SEN(sub-entry nozzle). Free opening of the ladle is desired and the SEN is properly shrouded to prevent ingress of air to oxidise the bath. The SEN with upward angle nozzle is preferred as the flow is smoothened and the flow pattern enables flotation of inclusion towards the top mould surface layers, where the mould powders have the ability to absorb inclusion. The mould powder choice is critical for steel grade. For example, the peritectic grade demand a different condition of solidification compared to a high carbon steel grade The wrong choice of mould powder may lead to sub-surface seams that may escape the notice during surface grinding of cc products yet may expose up during hot rolling. The super heat needs to be optimized..

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2. Ingot Technology
3. Technology of Continuous Casting of Steel,
4. TMT Bar Manufacturing Process.

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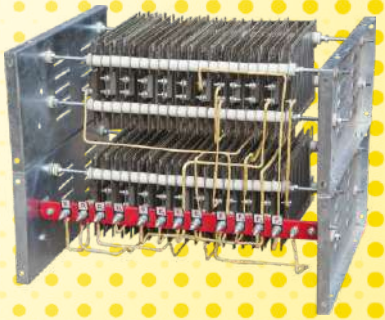

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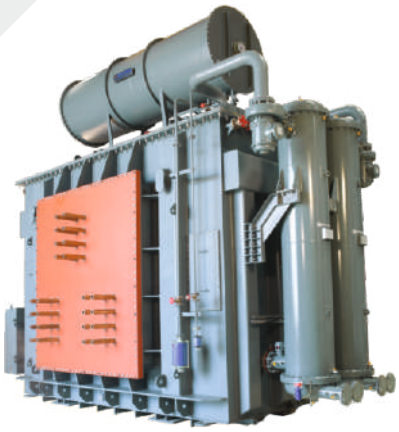

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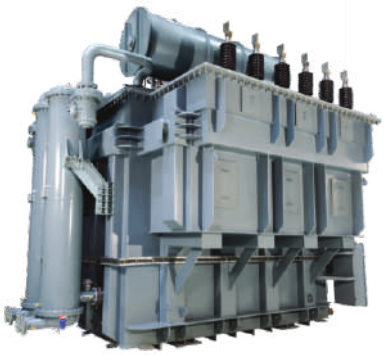

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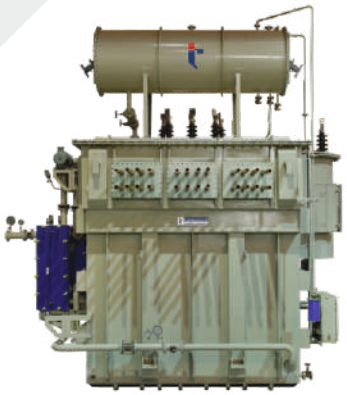

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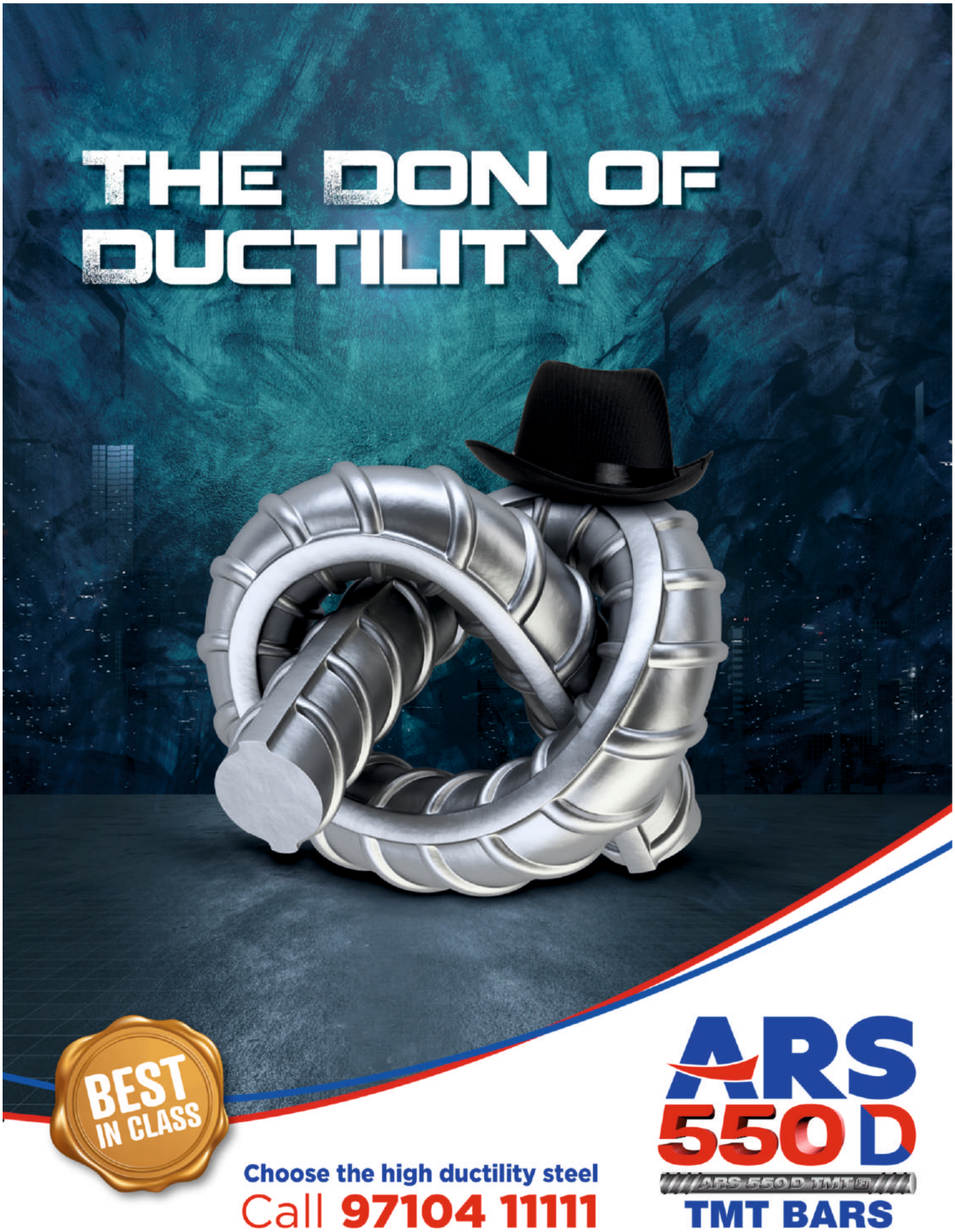
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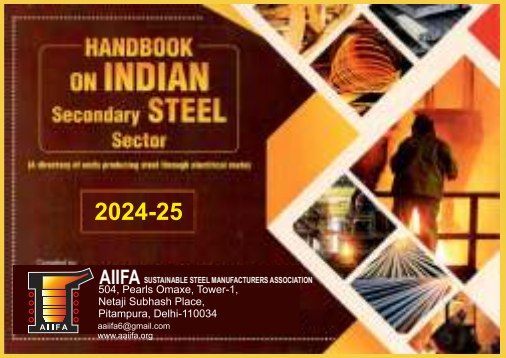

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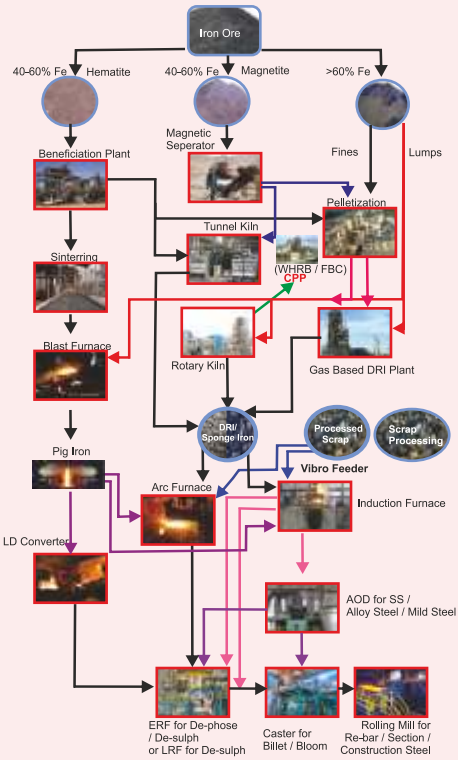

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