AIIFA SUSTAINABLE STEEL MANUFACTURERS ASSOCIATION

(FORMERLY KNOWN AS ALL INDIA INDUCTION FURNACES ASSOCIATION)

(Promoting Sustainability in Steel for Greener Future)

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What's Inside

हमारे सभी सदस्यों को होली की हार्दिक शुभकामनाएँ

AIIFA SECRETARIAT:

504, Pearls Omaxe, Tower-1
Netaji Subhash Place,
Pitampura
Delhi-110034, INDIA
Tel: 011-42725051/27351345
M: 9810410186/9810410815
Email: aaiifa6@gmail.com
Website: www.aaiifa.org
Twitter: SteelEx_AIIFA
Instagram: steelex_aiifa
Facebook: SteelEx AIIFA
YouTube: AIIFA NEWS

ELITE STEELS PVT. LTD.

Manufacturer of EOT Cranes, Electromagnets and Electro-hydraulic Grabs
Plot no. 13 & 14, Sector 25, Faridabad -121004 (Haryana) INDIA
Tel. +91-1292233170, 2232555
Mob. +91-9350360636
Email. info@elitecranes.com, marketing@elitecranes.com

REGIONAL OFFICES:

Delhi (HO): +91-9873355019 Kolkata: +91-9711302262
Chennai: +91-9890003480 Pune: +91-9311803902

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Enhancing the Reliability of Steel Product Properties Through Heat Treatment

P. Mishra, Sr. Executive Director
Srikumar Chakraborty, Consultant
AIIFA Sustainable Steel Manufacturers Association

Introduction

Heat treatment of steel products plays a crucial role in altering their physical and mechanical properties to achieve desired characteristics. This process not only enhances material performance but also facilitates subsequent manufacturing steps. By applying the correct heat treatment techniques, internal stresses developed during various processing stages can be relieved, making fabrication more efficient and ensuring the production of high-quality machinery components and parts.

During shaping operations, whether conducted in hot or cold conditions, residual stresses may develop over time, potentially affecting the product's integrity. Heat treatment effectively eliminates these stresses, ensuring improved structural stability and performance.

Steel products often require heat treatment based on their grade to attain essential properties such as increased hardness, toughness, strength, and durability. The process enhances wear resistance and refines material characteristics through carefully controlled heating and cooling cycles. This involves heating the steel to a specific temperature, maintaining it at that level for a designated period, and then executing controlled cooling to achieve the desired transformation.

The benefits of heat treatment include:

- Enhanced durability and toughness
- Improved weldability
- Increased wear resistance
- Greater flexibility and strength

Heat Treatment Processes and Their Applications

The choice of a heat treatment process depends on the functional and mechanical requirements of the steel product. Proper application ensures that the material meets the specified performance standards for different industries. Steel products benefit significantly from precise heat treatment techniques, particularly in applications involving hot forming processes.

Contrary to the common perception that heat treatment only hardens steel, it can also be used for softening. Softening processes make steel more malleable, allowing for metalworking operations such as deep drawing, cold forging, and machining. This balance of hardness and ductility is essential in achieving optimal material properties for various industrial applications.

In manufacturing highly critical components such as gears, shafts, and bearings, case hardening processes significantly enhance wear resistance and overall lifespan. These treatments not only improve the surface hardness of steel components but also increase fatigue resistance, ensuring longer and more efficient operational performance.

Heat Treatment of Different Steel Grades

Steel grades vary in composition and properties, requiring specific heat treatment processes to enhance their performance. The correct application of heat treatment ensures optimal strength, ductility, toughness, and wear resistance, making steel suitable for diverse industrial applications.

Low-Carbon Steel

Low-carbon steel is widely used in construction, structural applications, piping, and the automotive industry due to its balanced mechanical properties. However, it lacks corrosion resistance due to the absence of chromium. Its relatively simple chemical composition makes it easy to heat treat, allowing its properties to be modified based on application requirements. Heat treatment processes such as annealing help relieve internal stresses at the microstructural level, promote phase transformation, and enable grain recrystallization. These processes restore ductility, enhance toughness, improve machinability, and increase flexural strength.

Medium-Carbon Steel

Medium-carbon steels contain a higher carbon percentage than low-carbon steels, making them stronger and harder but less ductile. Due to their reduced formability and weldability, these steels often require quenching and tempering to achieve the desired mechanical properties. Proper heat treatment enhances their structural integrity and performance in demanding applications.

High-Carbon Steel

High-carbon steel has the highest carbon content among plain carbon steels and requires heat treatment to achieve the necessary hardness and strength. The heat treatment process typically involves multiple thermal cycles to refine its microstructure. For instance, 1095 high-carbon steel is commonly used for knives due to its excellent hardness after heat treatment. A standard process involves heating the steel to 200°C (400°F), holding it at this temperature for an hour, and then allowing it to cool gradually to refine its grain structure and enhance durability.

High-Strength Low-Alloy (HSLA) Steel

HSLA steel benefits significantly from quenching and tempering, a crucial heat treatment for fabricating heavy machinery and structural components. Quenching induces martensitic transformation, significantly increasing strength, while tempering enhances toughness by reducing internal stresses. This combination results in an optimal balance of strength and durability, making HSLA steel highly valuable in construction and manufacturing.

Alloy Steel

Alloy steels incorporate various alloying elements, enhancing their properties beyond those of plain carbon steels. Depending on the alloying content:

- **Low-alloy steels** (with total alloy content below 5%) offer improved strength and wear resistance.
- **Medium- and high-alloy steels** (with total alloy content ranging from 5% to 20%) provide superior hardness, toughness, corrosion resistance, and creep resistance when subjected to specific heat treatments.
- High-alloy steels also exhibit enhanced machinability and overall durability, making them ideal for demanding industrial applications.

Phase Transformations in Heat Treatment

The Fe-C (iron-carbon) phase diagram is fundamental in designing heat treatment processes for steel. Understanding critical temperature points ensures effective phase transformation during heat treatment:

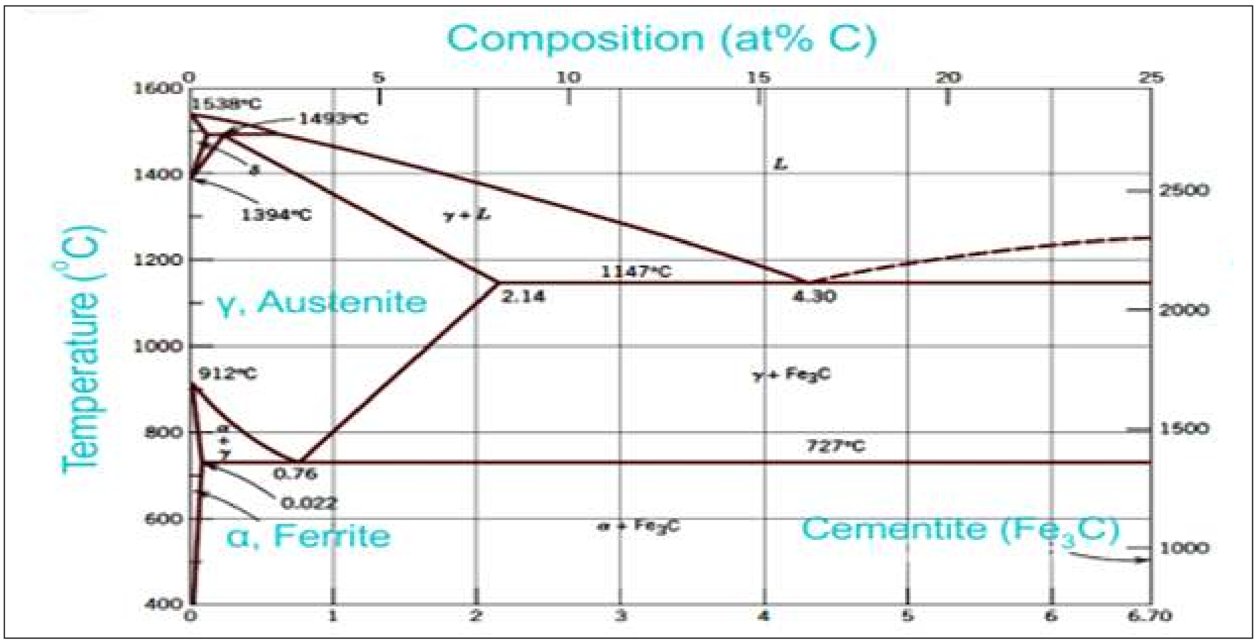
- **Upper Critical Temperature (A3)** – The temperature below which ferrite starts to form in hypoeutectoid steels (carbon content below 0.83%).
- **Upper Critical Temperature (ACM)** – The temperature below which cementite begins to form in hypereutectoid steels (carbon content above 0.83%).

- **Lower Critical Temperature (A1)** – The eutectoid transformation temperature where austenite converts into pearlite. Below this temperature, austenite no longer exists.
- **Magnetic Transformation Temperature (A2)** – The temperature below which α-ferrite becomes ferromagnetic.

Steel Microstructure at Room Temperature

- **Hypoeutectoid steels (0%–0.83% carbon):** Consist of proeutectoid ferrite and pearlite.
- **Eutectoid steel (0.83% carbon):** Composed entirely of pearlite.
- **Hypereutectoid steels (0.83%–2.06% carbon):** Contain proeutectoid cementite and pearlite.

By carefully selecting and applying heat treatment processes based on these principles, steel products can be tailored for specific industrial applications, ensuring optimal performance and longevity.

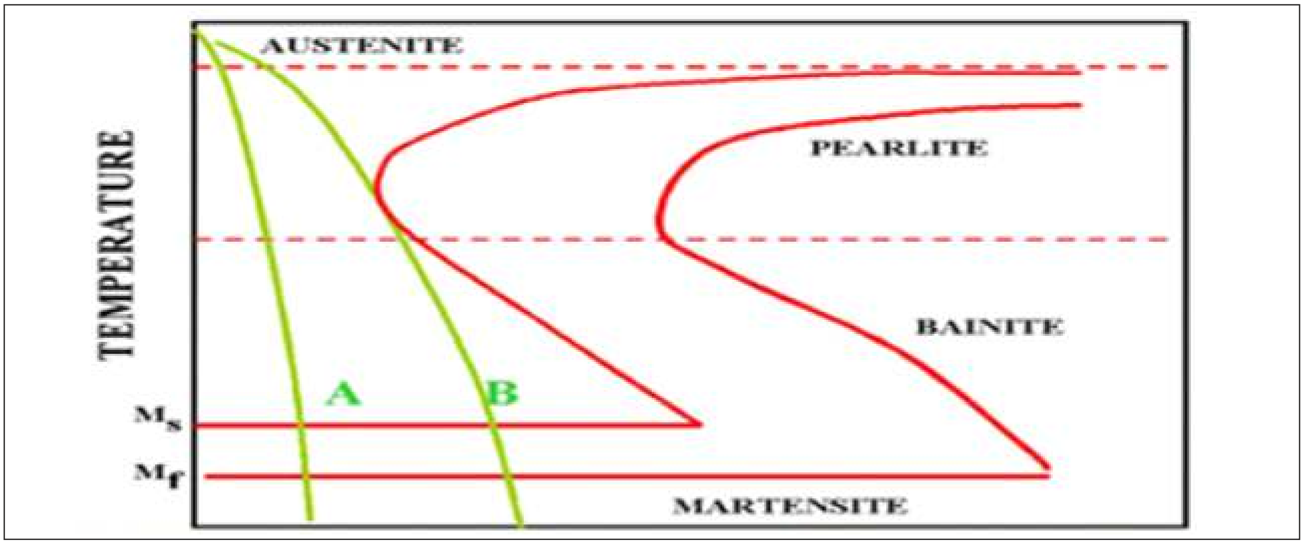


Iron-Carbon Phase Diagram

Steel with a carbon content ranging from 2.06% to 4.3% consists of proeutectoid cementite (C_2) that precipitates from austenite according to the ACM curve, along with pearlite and transformed ledeburite (where the austenitic phase in ledeburite has converted to pearlite).

The metallurgical properties of steel—such as hardness, toughness, and strength—can be modified through heat treatment processes. The primary objective of heat treatment is to achieve the desired mechanical properties while ensuring material integrity and preventing failures. In most cases, these modifications are carefully simulated and analysed to quantify the improvements in product performance.

Heat treatment plays a crucial role in determining the reliability of steel components. Many industries conduct heat treatment after fabrication or hot processing to relieve stress and prevent cracks, as these defects could lead to product failure during service. To ensure optimal performance, steel manufacturers must have a thorough understanding of specific heat treatment processes—such as annealing, stress relieving, normalizing, and hardening & tempering—while adhering to the principles outlined in the time-temperature-transformation (T-T-T) diagram.



Time-Temperature-Transformation Diagram

The Time-Temperature-Transformation (TTT) diagram serves as a simplified representation of the kinetics involved in pearlite and bainite formation, as well as the diffusion-less transformation of martensite. It consists of overlapping curves (A & B – Cooling Curve) that illustrate the start and completion of phase transformations, including austenite, pearlite, bainite, and martensite. The shape and position of these curves are influenced by factors such as alloy composition, grain size, and carbon content.

Understanding product specifications, process characteristics, and in-house facilities is essential for effective order booking and production planning. Proper assessment ensures that the required heat treatment is applied to achieve the desired mechanical and metallurgical properties of the final product.

Heat treatment is a critical process for altering the physical and chemical properties of materials. It enhances the performance of steel components by improving their durability, machinability, and resistance to wear. Ignorance of heat treatment principles often leads to misattributed quality concerns. For example, in fabrication, post-weld heat treatment (PWHT) is crucial, especially for welded tubes and pipes. The absence of PWHT can result in cracking, leading to premature failure.

Fabricators must have a fundamental understanding of the heat treatment processes necessary for their applications.

Alloy steel components undergo significant changes in their physical, chemical, and mechanical properties through heat treatment, facilitating ease of manufacturing while enhancing their final performance. These modifications ensure that the product can withstand operational stresses, resist wear, and maintain structural integrity. The choice of heat treatment method depends on the specific properties required for the material's intended application.

Processes such as annealing, normalizing, and stress relieving differ from hardening and tempering because they do not involve quenching. The key determinants of these processes are the heating temperature and cooling duration, both of which are influenced by the chemical composition of the steel, particularly its carbon and alloying element content.

Each of these heat treatment processes plays a vital role in controlling microstructural evolution, which directly impacts the mechanical properties and corrosion resistance of the treated steel. A well-optimized heat treatment strategy is crucial for enhancing the overall quality and performance of steel products in industrial applications.

Heat Treatment Processes

Heat treatment involves heating steel to a specific temperature range, holding it for a predetermined duration, and then cooling it at a controlled rate—either in a furnace or in air. Slow cooling is crucial for refining the microstructure, reducing hardness, and increasing ductility, which enhances formability and machinability. The most commonly used heat treatment processes include **annealing** and **normalizing**.

The soaking time during heat treatment is typically considered to be **one hour per inch of thickness** to ensure uniform temperature distribution and transformation throughout the material. The benefits of these processes include:

- **Increased ductility** – improving the material's ability to deform without breaking.
- **Improved machinability** – making the steel easier to cut, drill, or shape.
- **Enhanced electrical conductivity** – optimizing the material's performance in electrical applications.

Annealing Process

Annealing consists of three key stages:

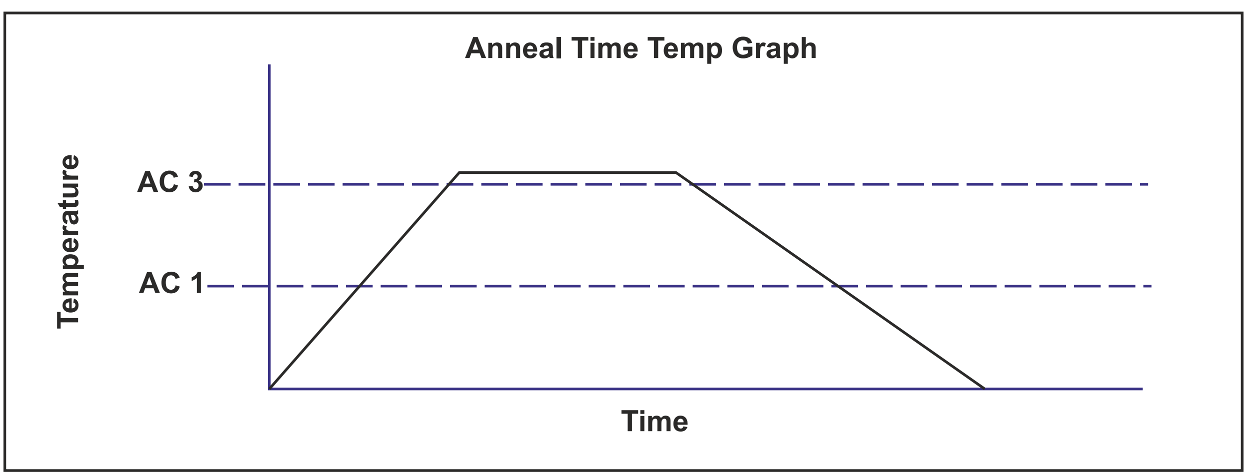
1. **Heating** – The steel is gradually heated to a temperature where austenitic transformation begins, typically between **700°C and 750°C**.
2. **Soaking** – The steel is held at this temperature until complete phase transformation occurs. At **Ac3 temperature**, the transformation of ferrite into austenite is completed. The soaking duration ensures the material reaches a uniform temperature.
3. **Controlled Cooling** – The steel is cooled slowly, usually inside the furnace, to promote a refined grain structure and relieve internal stresses.

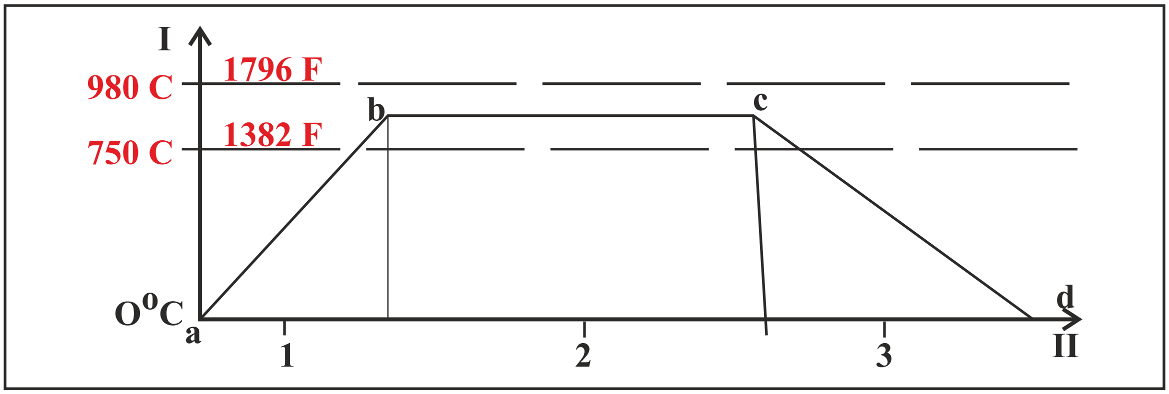
The **Ac1 temperature** represents the critical point at which phase transformation begins during heating. Reaching this critical temperature allows for the recrystallization of steel, improving its overall mechanical properties.

Proper heat treatment is essential to achieving the desired balance of strength, hardness, and ductility, ensuring that steel components perform effectively in their intended applications.

Normalizing Process

The normalizing process is primarily used to **relieve internal stresses**, enhance **ductility and toughness**, and refine the **grain structure** for improved uniformity. Similar to annealing, the steel is heated to a temperature just beyond the **critical transformation point (Ac3 line)** and held for a specified duration to ensure complete phase transformation.





However, unlike **annealing**, where the steel is cooled slowly inside the furnace, **normalizing involves air cooling** at room temperature. This faster cooling rate results in a finer and more uniform grain structure, leading to improved mechanical properties.

Key Benefits of Normalizing:

- **Stress relief** – Reduces residual stresses induced by previous manufacturing processes.
- **Enhanced grain structure** – Promotes uniform grain size and consistency.
- **Improved ductility** – Increases the steel's ability to deform without fracture.
- **Consistent microstructure** – Ensures better mechanical performance and reliability.
- **Increased hardness and strength** – Produces a stronger material compared to annealing.

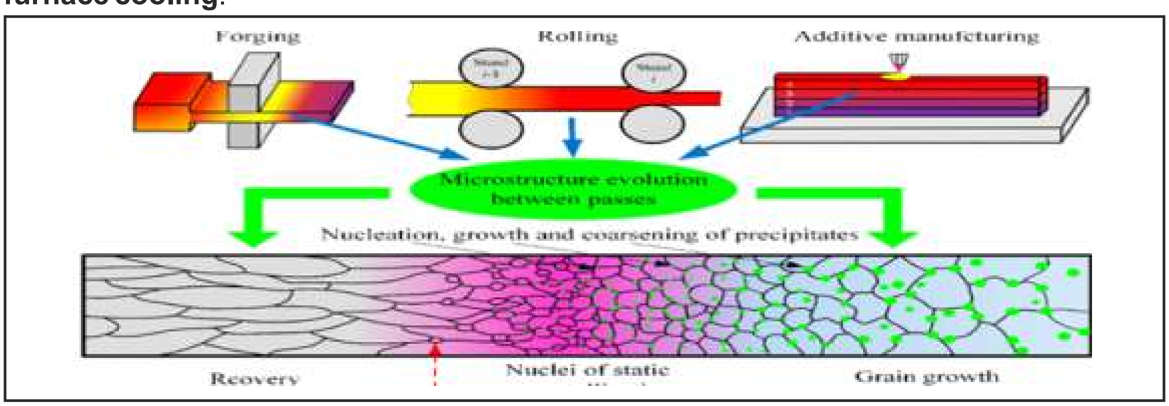
Comparison with Annealing:

- **Cooling method:** Normalizing uses **air cooling**, while annealing relies on **slow furnace cooling**.
- **Processing time:** Normalizing is **faster and more cost-effective**, as the furnace is freed up for the next charge. Annealing can take **8–20 hours**, depending on the steel's size and grade.
- **End properties:** Normalized steel is typically **harder and stronger** than annealed steel, making it a preferred process in industrial applications where higher mechanical strength is required.

Due to its **efficiency and cost-effectiveness**, normalizing is widely used in industrial manufacturing to optimize the mechanical properties of steel components, ensuring durability and performance in various applications.

Stress Relieving Process

Stress relieving is a crucial heat treatment process used to reduce residual stresses that develop in steel due to hot rolling, welding, cutting, or machining. By heating the steel to a temperature below the critical transformation point, this process minimizes internal stresses while preserving mechanical properties, unlike annealing or normalizing.



Stress Relieving Cycle (after Hot Working)

Key Benefits of Stress Relieving:

- Reduces residual stresses – Prevents distortion, cracking, and structural failures.
- Enhances machinability and formability – Makes subsequent processing, such as cutting and shaping, easier.
- Minimizes distortion – Improves dimensional stability during further manufacturing.

Application in Low-Carbon and Medium-Carbon Steels:

- Mild steel and medium-carbon steel lack sufficient carbon to undergo hardening and tempering.
- Medium-carbon steel may gain slight toughness but remains machinable with standard tools.
- Essential in steel fabrication – Lack of stress relieving can lead to defects and failures in finished products.

Process Parameters:

- Temperature range: Typically, between 650°C and 750°C, with 650°C being preferred for most applications.
- Holding time: Approximately one hour per inch of thickness to ensure uniform heat penetration.
- Effectiveness: Removes over 90% of built-up residual stresses, enhancing long-term stability.

Stress relieving is an essential process in steel fabrication and manufacturing, preventing warping, cracking, and machining difficulties. Proper application of this technique ensures that steel components remain dimensionally stable, structurally sound, and easier to process in subsequent operations.

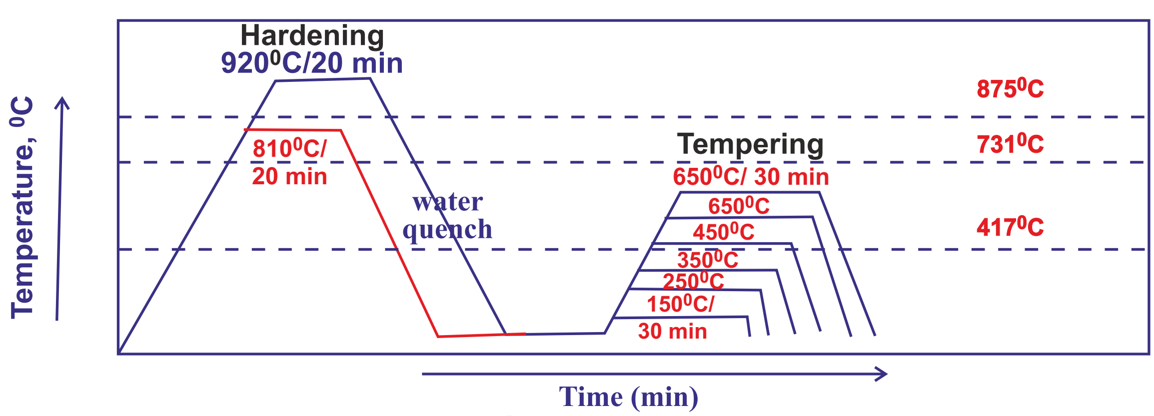
Hardening & Tempering of Engineering Steels

Hardening and tempering are critical heat treatment processes designed to impart the necessary **mechanical properties** to engineering steels, ensuring their suitability for **specific applications**. These treatments enhance the **strength, hardness, and durability** of steel components while maintaining an optimal balance of **toughness and resistance to wear**.

Hardening Process

1. **Heating:** Steel is heated to its appropriate hardening temperature, typically between **800°C and 900°C**, depending on its composition.
2. **Soaking:** The material is held at the target temperature to ensure uniform heat penetration.
3. **Quenching:** The steel is rapidly cooled in a suitable medium, such as **oil or water**, inducing structural changes that increase hardness.

The **selection of the quenching medium** is determined by factors such as steel composition and component geometry. The **limiting ruling section**—the maximum thickness at which full hardness can be achieved—must be considered in design specifications. As **quenching severity increases** (e.g., shifting from oil to water), hardenability improves, but there is also a higher risk of **distortion or cracking** due to thermal stresses.



Tempering Process

Post-quenching, the steel remains in its **hardest yet most brittle** state. To improve **toughness and ductility**, tempering is performed:

1. **Reheating:** The steel is heated to a controlled temperature, generally between **400°C and 700°C** for carbon steels (higher alloy steels may require temperatures up to **1300°C**).
2. **Holding:** The material is maintained at this temperature for a specified duration to achieve the desired properties.
3. **Cooling:** The steel is gradually cooled to refine its microstructure and mechanical properties.

Key Considerations in Hardening & Tempering

- **Higher alloy steels** may require **multiple tempering cycles** to achieve stability.
- **Spring steel**, widely used for **flat springs, blades, and saws**, is hardened and tempered before being formed due to its extreme difficulty in shaping post-treatment.
- The **balance between hardness and ductility** is crucial to ensure **optimum performance** in service conditions.
- By applying **precision-controlled hardening and tempering**, engineering steels gain the necessary **mechanical strength, wear resistance, and flexibility** required for industrial applications while minimizing risks of **brittleness and structural failure**.

Relationship Among Phases Due to Temperature Changes

Steel undergoes distinct phase transformations as temperature changes, leading to the formation of different microstructures. The key phases in steel include:

- **Ferrite (α-iron)**: A soft, ductile phase consisting primarily of iron with a very small amount of carbon (up to 0.02%). While inherently low in strength, ferrite gains some reinforcement through carbon addition.
- **Austenite (γ-iron)**: A high-temperature phase where carbon is dissolved in iron. Austenite plays a crucial role in hot-working and heat treatment processes.
- **Cementite (Fe_3C)**: A hard and brittle iron carbide compound that coexists with ferrite in many steel alloys, significantly influencing hardness and wear resistance.
- **Martensite**: A highly strong and hard phase formed through rapid cooling (quenching) of austenite. While martensite enhances strength, it can be brittle unless tempered.

Iron-Carbon Phase Diagram and Its Significance

The **iron-carbon phase diagram** serves as an essential tool for metallurgists, illustrating phase transformations based on temperature and carbon content. It defines key phase regions, including:

- **Ferrite (α-iron) phase field**
- **Cementite phase field**
- **Austenite (γ-iron) phase field**
- **Ferrite + Cementite region (Pearlite structure)**
- **Ferrite + Austenite region**
- **Austenite + Cementite region**

This equilibrium diagram helps predict phase changes during heating, cooling, and various metallurgical processes such as casting, solidification, and welding. Since material properties depend on phase composition, understanding these transformations is critical in alloy design and heat treatment strategies.

Strengthening Steel: Quenching and Tempering

Steel, while inherently strong, often requires further strengthening through **quenching and tempering**. This process involves:

1. **Heating** the steel above its critical transformation temperature to form austenite.
2. **Quenching** (rapid cooling in water or oil) to transform austenite into martensite, which is extremely hard but brittle.
3. **Tempering** (reheating to a lower temperature) to restore ductility while retaining strength, making the steel more resistant to cracking and failure.

This process is comparable to steaming vegetables and then cooling them rapidly in water to halt further changes. Quenching locks the structure into a hard state, while tempering fine-tunes the material's properties for practical applications.

Heat Treated Critical Alloy Steel Products

Shaft

Gear

Cold Rolling Mill Roll

Forged , Hardened, Tempered & Machined

Preferred Alloy and Special Steel Grades for Hardening & Tempering

Original Equipment Manufacturers (OEMs) typically prefer **alloy and special steel grades** that undergo **hardening and tempering** to enhance their mechanical properties. Some of the commonly used grades, primarily from the **EN series** (or their equivalent international specifications), include:

- **EN Series Grades**: EN 352, EN 255, EN 361, EN 362, EN 363, EN 325, EN 354, EN 355, EN 351, EN 36A/B/C, EN 39A/B, EN 13, EN 14, EN 15, EN 35A, EN 35B, EN 14A, EN 14A-1, EN 14B, EN 15B, EN 15A, EN 16, EN 16A, EN 16B, EN 16C/D, EN 19 series, EN 24, EN 100A/B/C/D, EN 110, EN 111, EN 111A, EN 23, EN 25, EN 26, EN 30A.

Role of Alloying Elements in Steel

The chemical composition of steel, particularly the presence of alloying elements like **carbon, manganese, sulfur, phosphorus, aluminum, nitrogen, nickel, and others**, significantly influences its properties. These elements help:

- Improve **microstructure** for better strength and durability.
- Enhance **fatigue strength** to withstand cyclic loads.
- Increase **corrosion and heat resistance** for demanding environments.
- Optimize properties for **low- and high-temperature applications**.
- Provide insights into the ideal **alloying element ratios** required for specific performance characteristics.

Applications of Alloy Steel

Alloy steel is widely used across industries such as:

- **Engineering & Manufacturing**: Heavy machinery, precision components.
- **Automotive**: Transmission gears, crankshafts, axles.
- **Aerospace & Aviation**: Structural components requiring high strength-to-weight ratio.
- **Defense & Military**: Armor plating, high-performance weaponry.

Heat Treatment & Process Considerations

Heat treatment plays a crucial role in refining the mechanical properties of steel. The process involves controlled heating and cooling to achieve the desired hardness, toughness, and ductility. Common heat treatment methods include:

- **Normal Annealing**: Softens steel, improves machinability.
- **Spheroidizing Annealing**: Enhances ductility and reduces hardness for further processing.
- **Hardening & Tempering**: Increases strength while maintaining necessary toughness.

For optimal results, process technology should prioritize the **effects of alloying elements** to tailor steel properties for specific end-use applications.

Heat Treatment Processes for Alloy & Special Steels

Optimization of Hardening & Tempering

Many industrial units conduct **controlled trials** to optimize **hardening and tempering** by varying **time and temperature parameters** during annealing, normalizing, and quenching, followed by tempering. In these trials:

- **Specimens are heated to 900°C** and cooled at different rates to analyze changes in **microstructure, hardness, tensile strength, and impact strength** before and after heat treatment.
- **Quenching increases hardness but induces brittleness**, requiring subsequent **tempering** to improve toughness and optimize mechanical properties.
- By comparing the obtained values, units refine tempering cycles to achieve the ideal balance between **strength, toughness, and cost efficiency**.

Influence of Alloying Elements

The major alloying elements—**nickel, chromium, manganese, molybdenum, vanadium, niobium, silicon, and cobalt**—are incorporated in varying amounts to enhance steel properties. Their effects include:

- **High weldability and toughness** after hot working and heat treatment.
- **Improved tensile strength**, crucial for structural steel applications.
- **Optimized heat treatment response**, ensuring enhanced performance based on end-use requirements.

Trials using **plain carbon steel with different percentages of Ni, Cr, and Mo** demonstrate how alloying elements influence final properties, enabling the selection of the most suitable steel grades.

Annealing of Cold-Rolled Steel

Cold-rolled steel grades undergo **annealing** after extensive deformation during processing to restore **ductility and formability**. This process involves:

- **Stress relief through recovery, recrystallization, and grain growth**, ensuring improved mechanical properties.

- Enhanced performance for **cold-rolled sheets and products**, making them suitable for high-precision applications.

Thermal Conductivity in Heat-Treatable Steels

The **thermal conductivity** of martensitic steels is critical for industrial applications. It affects:

- **Forging tool performance**, directly impacting product quality and production efficiency.
- **Heat treatment efficiency**, where improved conductivity ensures **uniform heating and cooling**.
- Ongoing **research and development** in heat treatment aims to enhance the thermal conductivity of tool steels, optimizing industrial processes (**Ref: Jens Wilzer et al., DOI: 10.1002/srin.201400294**).

Applications of Heat-Treated Medium Carbon Low Alloy Steels

These steels are widely used in:

- **Engineering & Ordnance** – Due to their excellent hardenability, strength, and toughness.
- **Power Generation** – For manufacturing large **steam turbine and generator rotor forgings**.

A typical heat treatment process includes:

1. **Two-stage austenitizing**, followed by **tempering and oil quenching**.
2. Ensuring **specified mechanical properties**, such as **transverse Charpy impact strength at -40°C and proof stress**.
3. Addressing **non-uniform mechanical properties** along the length of forgings through process optimization.

Challenges in Heat Treatment Science

Despite advancements, linking heat treatment science directly to **industrial processes and practices** remains complex. Key challenges include:

- **Transformation kinetics** of ferrite to austenite affecting precise furnace **ramp-up, soaking, and holding times**.
- **Process control requirements**, necessitating **robust heat treatment methodologies** for consistency and quality.
- **Furnace technology variations**, where factors such as **door seal condition, insulation type, thermocouple positioning**, and **temperature ramp-up control** influence heat treatment efficiency and cost.

Growing Demand for High-Performance Steel

Technological advancements in industries such as **automotive, aerospace, oil & gas, piping networks, and infrastructure** have increased the need for:

- **High-tensile strength steel** with improved ductility and toughness.
- Optimized **heat treatment processes** to ensure desired mechanical properties.
- **Energy-efficient heat treatment**, as this process accounts for **15–20% of total energy consumption** in the alloy & special steel industry (**Ref: Stefan Schart et al., Otto-von-Guericke-University, Germany**).

Conclusion

Heat treatment remains a **critical process** in steel manufacturing, ensuring **enhanced mechanical properties** tailored to specific industrial applications. The **continuous development of heat treatment techniques**, along with advancements in **furnace technology and energy efficiency**, is crucial for meeting evolving industry demands while maintaining **cost-effectiveness and sustainability**.

5 March 2025

Committed to Reducing Regulatory Burden: FM

The Centre remains steadfast in reducing regulatory burden and enhancing trust based governance to improve ease of doing business, FM Nirmala Sitharaman said on Truesday.

“Through the budget announcements, we are taking various steps in making India a seamless, export-friendly economy one where businesses are free to focus on innovation and expansions, and not paperwork and penalties,” she said, addressing a post-budget webinar titled “Making India investment Friendly', Decriminalization of business-related laws reduces the legal risk, allowing industry to operate with greater confidence, Sitharaman said. More than 42,000 complaince requirements have already been removed and over 3,700 legal provisions have been decriminalised since 2014, she noted.

Chief economic advisor Ananth Nageswaran said foreign investment plays a crucial role in economic growth and development and India, being a current account deficit country needs both portfolio and direct investments. “Gworth will come under pressure across the world and therefore it is very incumbent on us to do all we can to sustain a mood of optimism in the country,” he said.

Source: The Economic Times

8 March 2025

Steel Cos may Go Slow on Capacity Expansion as Imports Hit Margins”

Steel companies may hold back investments to expand capacity as increasing imports shrink profit margins and eat into their market share, said analysts.

India aims to achieve the target of 300 mt crude steel capacity by 2030 under its National Steel Policy.

“Steel capacity expansions may slow down in case domestic steel prices are adversely impacted due to increasing imports,” said Amit Bhargava, partner and national head metals and mining, KPMG in India.

There is a growing discomfort about domestic demand being served by steel from China of South Korea. The latest tariff was has added to the uncertainty. Analysts said these factors are playing out with no fresh announcements on investments being made.

“Many steel producers are not announcing new investment plans as there is growing apprehension that increasing imports may eat into their market share,” said Ritabrata Ghosh , vice president and sector head-corporate ratings at ICRA.

They don't want to take a lot of debt for expansion in this environment, which is why they are recalibrating their investment plans, he added.

The country a crude steel capacity is currently around 180 ml, with another 120 mt to be added in the next five years, which will require nearly $120 billion in expansion.

Profitability may remain that in next fiscal, say analysts. Rohit Sadaka, director and head, materials and diversified industrials, Ind-Ra. Predicted profitability of steel pla-years to be range bound in 2025-26

Source: The Economic Times

Jaishankar on Kashmir: Exposing Global Double Standards

During his address at the Raisina Dialogue session titled 'Thrones and Thorns: Defending the Integrity of Nations', External Affairs Minister S. Jaishankar strongly advocated for a fair and equitable international order, one that upholds justice and sovereignty without prejudice. He criticized the United Nations (UN) for its flawed handling of the Kashmir issue, accusing the organization of distorting the reality by placing the aggressor and the victim on equal footing. Referring to Pakistan's occupation of parts of Kashmir, Jaishankar described it as the "longest-standing illegal occupation" of any territory since the Second World War. He denounced the role of Western powers—including the UK, Canada, Belgium, Australia, and the USA—in misrepresenting the invasion as a dispute rather than an act of aggression. This mischaracterization, he argued, not only undermined India's sovereignty but also exposed the inherent biases within the global governance framework, where political convenience often outweighs principles of justice.

Condemning Western Hypocrisy and Geopolitical Bias

Jaishankar further highlighted the West's duplicity in its approach to political interference. He pointed out how Western nations frequently justify their interventions in other countries under the pretext of promoting democratic values, while viewing similar actions by non-Western powers as malign or illegitimate. This hypocrisy, he argued, reflects the entrenched power dynamics that shape the global order, where rules are selectively applied based on strategic interests. By calling for a *"strong and fair"* UN, Jaishankar underscored the need for meaningful reforms to ensure genuine impartiality in addressing territorial disputes. His remarks resonated with India's growing demand for a transparent and just international system—one that respects sovereignty, ensures accountability, and resists the influence of geopolitical power plays.

Source: Money Control

Trends and Projections in India's Ferrous Scrap Consumption

India's steel industry has witnessed a consistent rise in ferrous scrap consumption, driven by the sector's decarbonization goals and growing steel production. In FY24, the country consumed **39 million tonnes (mnt)** of ferrous scrap, with a slight dip projected for FY25 to **37 mnt**, comprising **31 mnt** for steel-making and **5.5 mnt** in foundries. Despite the decline, the increased reliance on domestic scrap generation is notable, although it still falls short of meeting the industry's growing demand.

India remains a net importer of ferrous scrap; however, imports are expected to decline by over **30%** to approximately **7 mnt** in FY25, down from **10 mnt** in the previous fiscal year. The share of imported scrap also fell by **19%** in the first ten months of 2024 (10MCY'24), reaching **7 mnt**, compared to **9 mnt** in the corresponding period last year. Conversely, domestic scrap consumption grew by **22%** during this period, reflecting a stronger domestic supply base.

The steel sector's push for **decarbonization** has made ferrous scrap a vital resource, as its increased usage significantly reduces carbon emissions. The **National Steel Policy of 2017** projected the ferrous scrap requirement to reach **16 mnt** by 2030, underscoring its importance in sustainable steel production.

In 2023, India produced **140.2 mnt** of steel, securing its position as the world's **second-largest steel producer**, while per capita steel consumption rose from **59 kg** in 2013-14 to **119 kg** in 2022-23. Finished steel consumption also increased from **100.171 mnt** in 2019-20 to **136.291 mnt** in 2023-24.

Looking ahead, the industry is gradually adopting **indexation and global risk management practices** to enhance price stability and optimize procurement strategies, signaling a more resilient and efficient approach to ferrous scrap consumption.

Source: The Economics Times

SAIL to Expand Rourkela Steel Plant Capacity to 9 MTPA by 2030 with ₹30,000 Crore Investment

State-owned **Steel Authority of India Limited (SAIL)** is set to significantly scale up the capacity of its **Rourkela Steel Plant (RSP)** to **9 million tonnes per annum (MTPA)** by **2030**, with an investment of approximately **₹30,000 crore**. This ambitious expansion aims to bolster supplies to critical sectors such as **defence, oil & gas, and automobiles**, reinforcing SAIL's position as a key player in India's steel industry. Upon completion, RSP will contribute around **25%** to SAIL's overall targeted production capacity of **35 MTPA** by 2030. The project, covering **1,200 acres** on the plant's southeastern side, marks a major greenfield growth initiative.

Located in **Rourkela, Odisha**, around **320 km from Bhubaneswar**, RSP holds the distinction of being India's **first public sector steel plant**, established in collaboration with Germany in the **1950s** with an initial capacity of **1 MTPA**. The plant became operational on **February 3, 1959**, when **Dr. Rajendra Prasad**, the then President of India, ignited its first blast furnace, *Parvati*. Currently, SAIL's total steelmaking capacity stands at **20.3 MTPA**, with RSP contributing **4.4 MTPA**. The expansion will add an additional **5 MTPA**, raising RSP's total capacity to **9.4 MTPA** by 2030.

The project will significantly enhance RSP's product portfolio by expanding the production of **high-value steel products** such as **plates, hot rolled (HR) coils, spiral welded, and electric resistance welded (ERW) pipes**. It will also increase the output of **cold rolled non-oriented (CRNO) sheets**, which are used in **shipbuilding, rail wagons, LPG cylinders, automobiles, oil & gas**, and **electrical applications** like motors, generators, and transformers. Additionally, RSP's dedicated mill will produce **naval-grade, armour-grade, and quenched & tempered plates** for defence and naval applications.

As part of the expansion, RSP will undergo significant infrastructure upgrades. Key developments include the installation of a **raw material handling plant** for efficient processing and transportation of raw materials, a **coke oven stamp-charge battery** to enhance coke production capacity, and a **sinter plant** to improve iron ore processing efficiency. The project will also introduce a **thin slab caster-direct rolling facility** and a **cold rolling mill** to boost the production of flat steel products. A **silicon mill** and logistics enhancements will support the production of specialized steel products, while a **new blast furnace and steel melting shop** will scale up primary steelmaking capacity.

To strengthen logistics, a **dedicated railway line** connecting **Dumertra station to RSP** is under construction. This will streamline the transportation of raw materials and finished goods, reducing congestion at **Bondamunda Yard**. The **South Eastern Railway** is executing the project under a **cost deposit scheme**, with the requisite funds already deposited by RSP.

SAIL, operating under the **Ministry of Steel**, is among India's top three steel manufacturers. In addition to RSP, SAIL operates four other integrated steel plants: **Bhilai Steel Plant (BSP)** in Chhattisgarh, **Bokaro Steel Plant (BSL)** in Jharkhand, **Durgapur Steel Plant (DSP)** in West Bengal, and **IISCO Steel Plant** in Burnpur, West Bengal. The RSP expansion is a part of SAIL's broader vision to enhance production capacity, strengthen supply capabilities, and meet the rising demands of India's infrastructure and industrial sectors.

Source: The Economics Times

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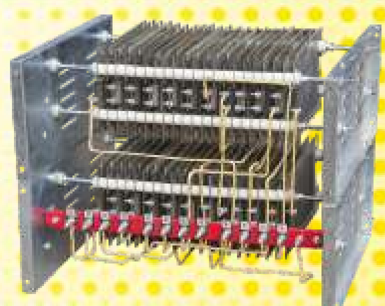

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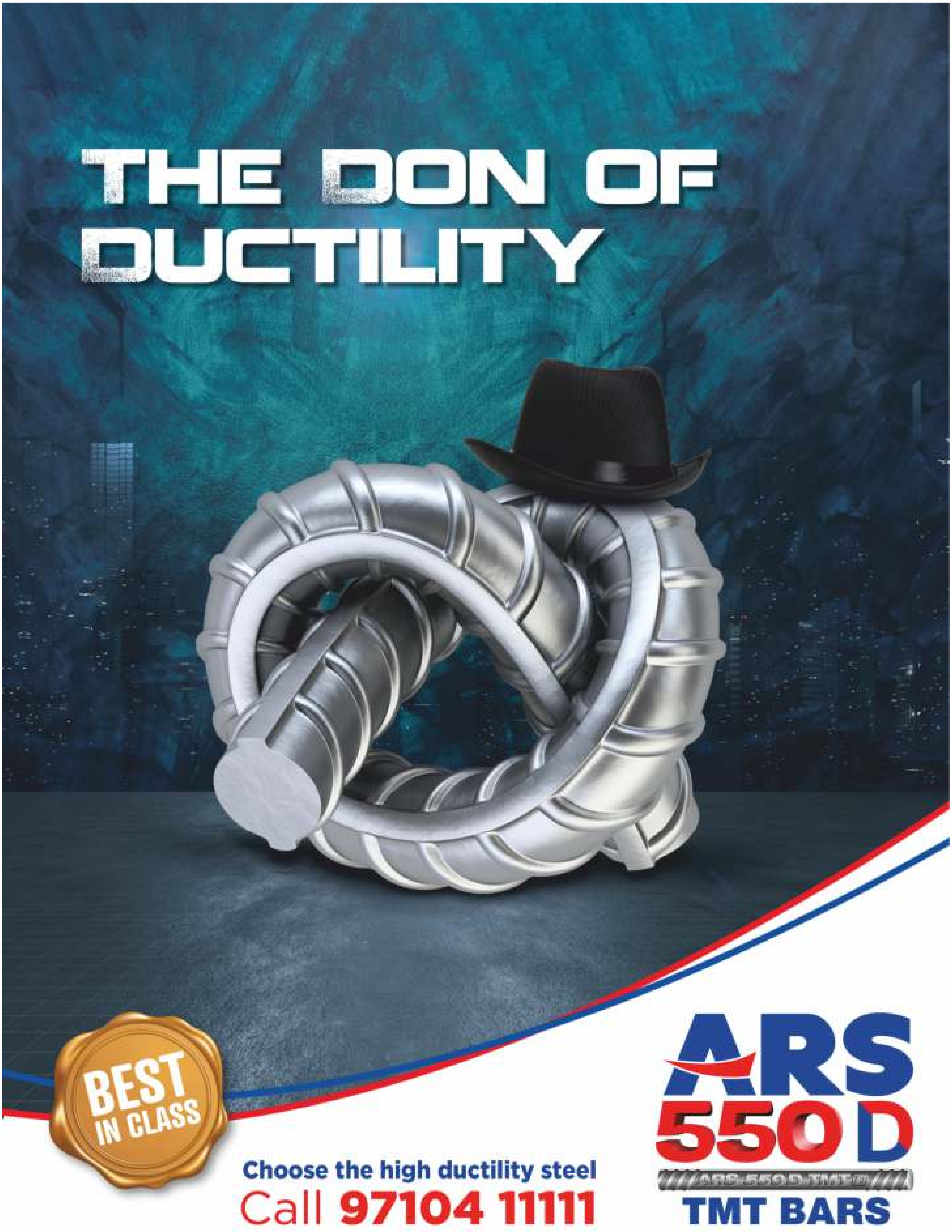
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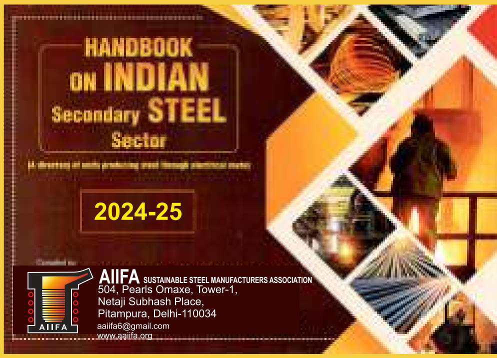

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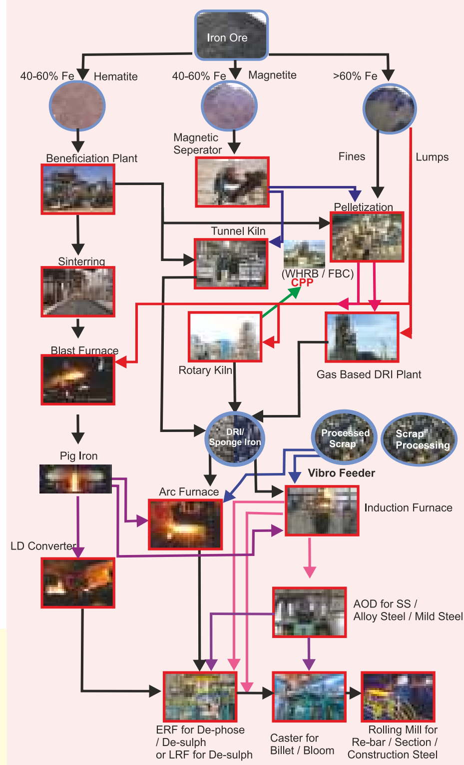

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