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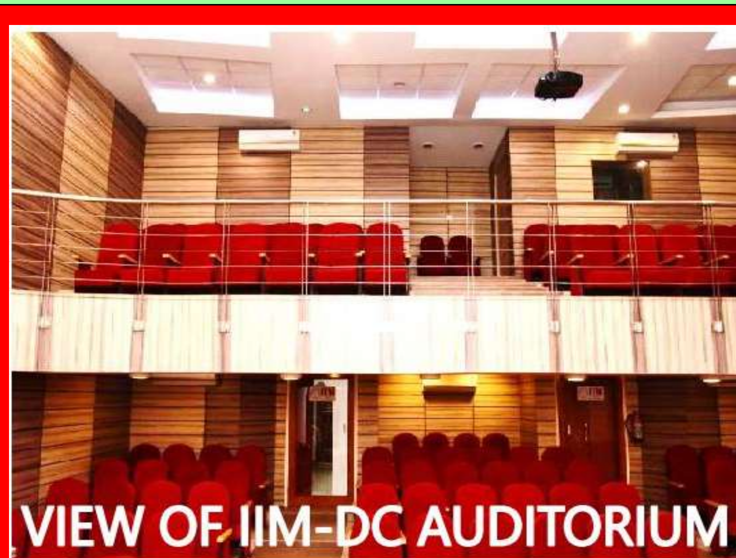

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BRIEF REPORT ON TECHNICAL TALK ON "PELLETISATION: INDUSTRY OVERVIEW AND MECON'S ROLE" BY MR. KUNAL SINGH

A Technical Talk on *"Pelletisation: Industry Overview and MECON's Role"* was organised by IIM Delhi Chapter on Google Meet Platform on 26 June 2021.

At the outset, Shri K K Mehrotra, Chairman IIM Delhi Chapter welcomed all the participants to the Technical Talk. He welcomed the speaker - Mr Kunal Singh, *Assistant General Manager, Ironmaking Division,* MECON. Mr. Mehrotra gave brief details about the activities of Indian Institute of Metals at national level. He also highlighted the activities being undertaken regularly at Delhi Chapter level even during the present challenging times. It was emphasised that the focus of the programmes being organised is on different issues related to metallurgical industry and to keep members abreast during COVID times.

Shri Nirmal Kakkar Honorary Secretary, IIM Delhi Chapter introduced the speaker, Mr. Kunal Singh. After introductory reference, the floor was handed over to Mr Singh.

Mr Kunal Singh made his presentation under 4 broad heads, viz.

- Why Iron Ore Pellets
- Pelletisation, one of Agglomeration routes
- MECON's involvement and Capability
- MECON's range of Services

Mr Singh focussed on the fact that as the reserves of good quality iron ore reserves are depleting fast & excessive fines are being generated during ore handling, it becomes important to beneficiate/agglomerate the fines for their effective usage in modern blast furnaces, DRI plants and Corex plants. Beneficiation/pelletisation also assists in exercising effective control on physical/chemical properties of feed material.

The benefits of using pellets vis-à-vis sinter, viz. utilisation of ultra iron ore fines, micro fines & low grade ore fines; lesser generation of pollutants; uniform size and chemical properties; higher tumbler index & compressive strength resulting in little generation of fines during transportation and usage in kilns/blast furnaces etc. were highlighted

The Speaker touched upon different pellet making processes (Straight grate/Travelling Grate and Grate Kiln Cooler) with the help of process flow sheets and plant layouts. He also described, in short, various equipment viz. Disc Pelletiser, Green Pellet screening, Indurating machine, Indurated pellet screening, Rotary Kiln, Annular Cooler etc.

A global as well as Indian overview regarding various technologies adopted as well as the capacities installed/utilisation for pellet making was provided. While the installed capacity in

India is ~ 98 MTPY, the utilisation is in the range of 66-71%. In view of projected increase in Indian steel production by 2030 as well as potential for pellets export to Middle East, China, Asian countries, Egypt etc., there is vast scope in pellets making plants in India

MECON's association with setting up of pelletisation plants - new plants at Nigeria, Mangalore, Vizag during 1980s; expansion of existing plants at Vijaynagar and Vizag during 1990s; new plants at Vizag, Hospet in 2000s; new plants at Rengali, Jaipur, Dolvi, Vijayanagar in 2010s and the ongoing plant at Ukraine, were highlighted. The capacities handled by MECON have raged from 1.2 to 8.0 MTPA.

Mr. Singh concluded his presentation by providing an overall view of all services being offered by MECON viz. EPC execution (from concept to commissioning), Engineering services, site services, project feasibility etc.

The presentation which was supported by power point presentation materials evoked a lively response amongst the audience. There were a number of interesting questions/observations and suitable responses amongst the participants after the Presentation

The talk was attended by about 60 IIM DC members as well as members of PMAI (Pellet Manufacturing Association of India).

The audience found the programme very interesting and informative.

Mr. Nirmal Kakkar, Hony. Secretary, IIM DC, proposed a vote of thanks to Mr Kunal Singh, his organisation MECON and all the participants in the Technical Talk.

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CHALLENGES OF STEEL SECTOR DECARBONISATION

Abstract

Imbibing an underlying responsibility towards planet Earth in our operations, ensuring the health and safety of people at our workplaces, balancing economic prosperity and generating social benefits for the community are the core values which are deeply entrenched in Tata Steel's DNA. As a responsible corporate, Tata Steel supports the UN Global Compact and strives to integrate its 10 principles in all facets of business. Climate change is recognised globally as one of the key risks in the 21st century. Tata Steel has undertaken many initiatives in last decade to reduce our carbon intensity by more than 25%. However, the deep decarbonisation of steel sector will require breakthrough technologies and use of alternate fuel like hydrogen. The recently launched IEA Steel Sector report outlines the challenges of the sector and outlines a roadmap for long term decarbonisation. This article will talk about the decarbonisation challenges of steel sector which has been referenced from the IEA report and also touch upon Tata Steel's initiatives for deep decarbonisation.

Introduction

Studies claim that carbon dioxide concentration in atmosphere has increased in pre-industrial era from 280 ppm to more than 400 ppm in Oct 2019. The average temperature of earth has already increased by one degree centigrade above pre-industrial level on account of higher concentration of GHG (greenhouse gases) in atmosphere. The impacts of climate change on society and environment will largely depend on humankind response through technology, lifestyle, economy and policy. Since these responses are uncertain, future scenarios are used to explore the consequences of different options.

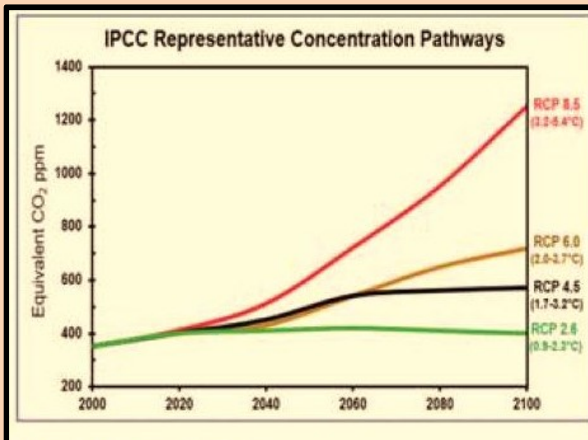

Fig: 1: Ref: IPCC Report

IPCC in its Fifth Assessment Report (AR5), 2014 has used four Representative Concentration Pathways (RCP) to depict the concentration trajectory of greenhouse gases in atmosphere and to model their impact on climate change for end of this century, as shown in Fig. 1.

The commitments made in Paris Agreement in 2015 will undergo a test of credibility at COP26, scheduled in November this year. While some countries have made their net neutrality commitments, the corresponding actions in line with the ambitions are yet to be witnessed. Recent reports claim that only India's NDC is in line for the 2-degree warming scenario amongst the G20 countries while most other countries are still on 2.5- or 3-degree trajectory.

Steel: A Hard-to-abate Sector

The iron and steel sector is highly energy intensive industry, with coal accounting for about 75% of its energy inputs today. In 2019, the sector's consumption of coal stood at around 900 million tonnes of coal equivalent.

In other words, around 15% of global primary demand for coal is sourced for the steel industry. Coal is largely consumed in the blast furnace, a major proportion of which is transformed from coal to coke in the coke oven beforehand.

Steel industry accounts for nearly 7% of total GHG emissions and after power and chemical sector is the third largest emitter of carbon dioxide. Since the technologies for reducing the carbon emissions are yet to be technically feasible and economically viable, steel is considered as hard to abate sector.

Steel: An Indispensable Alloy

Life of Steel production assets are reasonably long. Most of it is produced through the traditional Blast Furnace – Basic Oxygen Furnace (BF- BOF) route. While, the basic counter-current blast furnace process for producing iron has remained the same for centuries, yet breakthrough improvements in cooling technology, process automation & allied processes ensured that it stays ahead of both competing materials as well as competing iron making technologies. Alternate materials like composites, glass, plastics, aluminium or carbon fibre have found it difficult to completely replace this alloy of iron, because of following characteristics:

- For its cost, steel has the highest strength to weight ratio
- It is infinitely recyclable, without losing its inherent properties
- The existing ecosystem of steel for education, manufacturing, design & supply chain has taken decades to build, and is difficult to replicate.

So, steel continues to remain a material of choice for sectors like Construction, Auto, Capital Goods and Consumer Durables.

By 2050, the cost of steel production is likely to increase as the need to decarbonise steel takes precedence, yet, production of steel will be higher as compared to current levels to meet growing demand of emerging markets.

Steel is the third most abundant man-made bulk material on earth, after cement and timber. The steel industry forms an integral part of many economies and is also one of the most widely traded commodities in the world, with producers competing in an international market. The industry has faced several economic shocks in recent years, including overcapacity, trade tensions and low margins for producers. The steel industry and our global economic system are therefore deeply intertwined. Steel needs energy and the energy system needs steel. Even though the stock of steel in advanced economies saturate, it will be required to support a growing population and rising levels of economic welfare, particularly in emerging economies. Iron and steel production are a highly energy intensive industrial sector accounting for 20% of industrial final energy consumption and around 8% of total final energy consumption.

Steel is also a critical input for the clean energy transition. Steel is a key input material for wind turbines, transmission and distribution infrastructure, hydropower and nuclear power plants, among other critical energy sector assets. While being a facilitator of the clean energy transition, steel is also a large contributor to the current challenge we face in meeting our climate goals: direct CO_2 emissions.

Steel Demand in India to Grow

As per IEA, the dominance of the China in global production declines from just over 50% today to 35% in 2050, as India's production more than triples to cater for booming domestic demand. A dynamic growth is expected to take place in many emerging economies, particularly in India. This compensates for the decline in output from China, which is in the process of shifting its industrial structure towards less energy-intensive activities after having satisfied a certain level of infrastructure and housing development.

As of now, India's per capita steel consumption is only one-third of the world average. However, various studies suggest and predict that increasing population, rapid urbanisation, mobility and infrastructure requirements and government initiatives such as 'Make in India' are expected to boost steel demand growth. In addition, the government's focus on accelerating the rural economy and plans for building smart cities, affordable housing, dedicated freight and high-speed rail corridors, are expected to create significant demand for steel. The National Steel Policy (NSP) envisages per capita steel consumption to almost double to 160 kg by 2030-31. With a leadership position in chosen market segments and world-class production facilities, Tata Steel is well poised to benefit from this large opportunity.

At Tata Steel

Cognisant of India's commitment and the sectoral requirements, Tata Steel India (TSI) has been able to bring down its carbon footprint by improving resource efficiency and adoption of best available technologies. Tata Steel Jamshedpur is the Indian benchmark for CO_2 emission intensity at 2.27 tCO_2/tcs and has reduced from 3.12 tCO_2/tcs in last 15 years with significant CAPEX investments to adopt best available technologies.

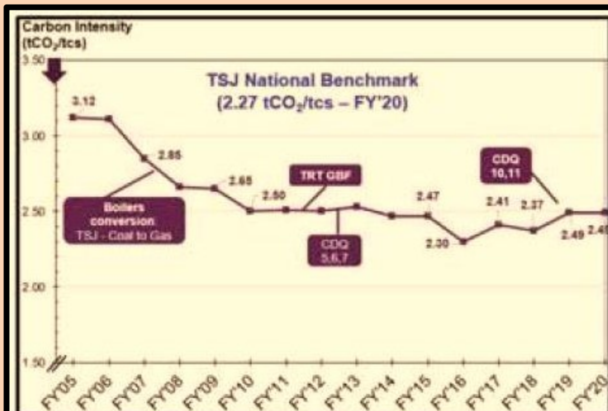

Fig. 2: Tata Steel India's journey to decarbonisation

TSI has been working with Government agencies and policy think-tanks to push for policy changes to support our interests while moving to clean technologies. For TSI, availability of economically viable clean scrap would be a major driver for sustainable growth. Accordingly, a separate business vertical of Scrap Recycling Business (SRB) has been created to make India future ready for higher scrap usage in steelmaking. This will also help in formalising the sector which is currently fragmented. The short-term target for Tata Steel India is to achieve

<2 tCO_2/tcs GHG emission intensity by 2025 by adoption of best available technologies at all operating sites. The long-term decarbonisation roadmap is being developed and scenario based modelling has been used to create different possibilities in line with the climate models of IPCC.

Scenario based modelling

Since the uncertainties in the longtime horizon (2020 – 2050) would be many, scenario based modelling is a good tool to model the decarbonisation trajectories based on the IPCC climate change models. The IEA Iron & Steel Technology Road map has also used scenario modelling to project steel consumption and the resultant CO_2 emissions. Two scenarios have been considered in the report. STEPS (Stated Policies Scenario – reflecting the impact of existing policy frameworks and today's announced policy intentions.) and SDS (Sustainable Development Scenario - how the world can change course to deliver on the main energy related Sustainability Development Goals (SDGs). As shown in Fig. 3, the IEA scenario based modelling predicts that CO_2 intensity of steel will come down, however it will not become zero by 2050 even in SDS scenario.

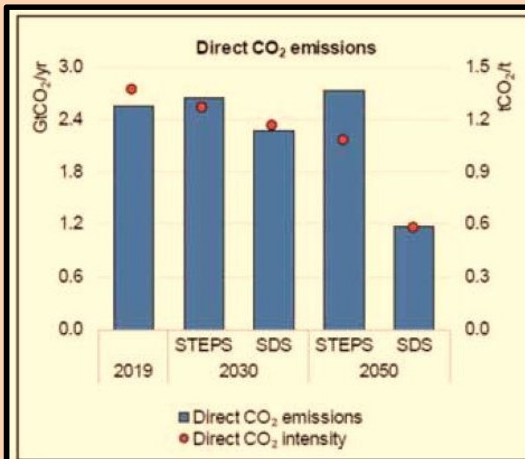

Fig. 3: IEA-Direct CO_2 emissions and energy consumption

The relative importance of different mitigation option evolves over time:

- In the short-term, the largest role is played by energy and material efficiency (BAT/BPT). BAT-Best available technology, BPT – Best Practises Technology
- In the medium-term, option to switch fuel to less intensive alternatives like natural gas, bio-energy and electricity are predicted to become viable
- Development of zero technologies may become viable only in the long-term (2035 & beyond)

Material Efficiency & LCA

Improvement in material efficiency will be one of the biggest levers for reduction in absolute emissions, as it contains overall demand of steel. Primary reasons for this are

- Improvement in yields till semi manufacturing stage – 7% of cumulative reduction.
- Improvement in yield till product stage – 12%
- Change in design and end-use products -12%

- Reducing over specs
- Optimizing sections and profiles Innovative modular designs
- Light-weighting through use of higher-grade steel
- Increasing use of pre-tensioned and pre-cast concrete

- Extension of life-time of buildings – 30%

Initiatives at Tata Steel for Improving Material Efficiency in Life Cycle of Products

- Life Cycle Assessment (LCA) of steel products for Environmental Product Declaration (EPD)
- LCA models developed for TSJ and TSK sites with plan to cover all sites
- Joint projects with auto customers to augment use of high strength steel grades
- Tata Pravesh and Tata Structural are the first steel products to receive GreenPro certification in India
- Plan to come out with first EPD for products used in construction sector e.g. Tiscon (TMT Rebars) and Pravesh (Steel Doors)

Best Available Technology & Energy Efficiency

Over the years, the adoption of best available technologies for waste heat recovery such as Top Recovery Turbine (TRT), Coke Dry Quenching (CDQ), use of by-product gases in power generation and other energy efficiency initiatives have resulted in improving resources efficiency as well as reducing carbon footprint. Tata Steel has focussed extensively on energy efficiency initiatives using following levers;

- Maximise use of by product gases for power requirements
- Maximise Process waste heat recovery for power generation e.g. CDQ and low temperature heat recoveries
- Enhance efficiency of gas-based power generation
- Fully exploit other potential energy recovery sources like Top Recovery Turbine (TRT), Micro turbines, Vapour Absorption Machine (VAM) using low grade waste heat etc.
- Exploit solar power potential in and around manufacturing sites

Following results have been achieved because of these initiatives:

- **TSJ** - Achieved best by-product gas utilisation of 98.44%
- **TSJ** - Achieved highest ever in-house power generation of 245MW by utilising by-product gases and through waste heat recovery
- **TSJ** - Achieved lowest ever power rate of 378 kwhr/tss.

In addition, Tata Steel has commissioned pilot project on 'Energy Recovery Micro Turbine' to recover throttling loss in pressure reducing station for de-aeration application of Boiler feed water and commissioned pilot project on 'Vapour Absorption Machine' to utilise the waste heat of Boiler blow-down water and condensate/ steam from steam traps.

Technology

To achieve the stringent target set before the steel industry and being a responsible corporate citizen, Tata Steel understands that radical shift in technology is imperative for deep decarbonisation. However, these technologies are yet to mature to a commercially viable level. Hence, as a strategy, Tata Steel is preparing itself extensively on a suite of technologies which are at various levels of readiness. Some of the technologies that would be key to decarbonisation of steel industry are as follows:

Top Gas Recycling (TGR)

TGR technology is based on lowering the usage of fossil fuel with the re-usage of the reducing agents (CO and H_2), after the removal of the CO_2 from the top gas. This leads to lower the energy requirements. Because of the advantages of high productivity, high PCI (pulverized coal injection) rate, low fuel rate, and low CO_2 emission, TGR-BF process is considered to be a promising Ironmaking process in future.

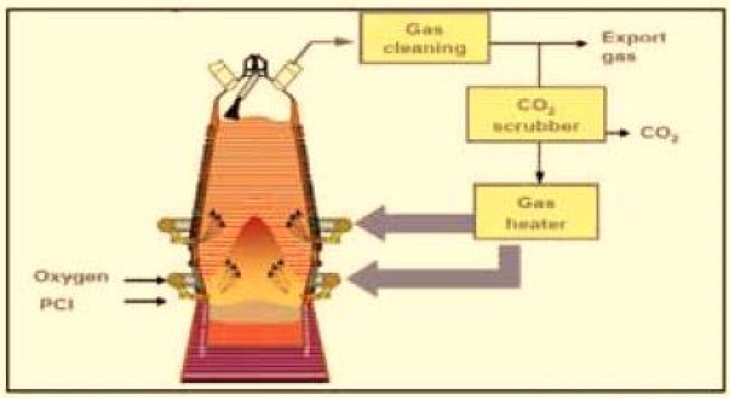

Fig. 4: Process route for top gas recycling

The technology has been developed and the demonstration of concept feasibility at experimental blast furnace scale has been done. Planning is ongoing to demonstrate the concept at industrial blast furnace scale.

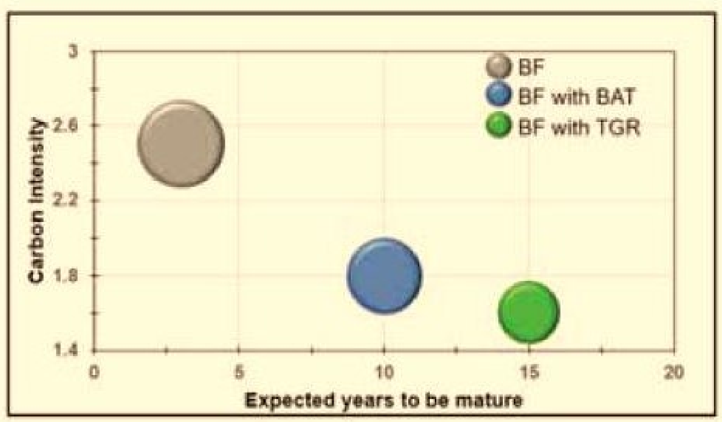

Fig. 5: A comparison on the carbon intensity of each technology versus the expected years for its maturity

Tata Steel has initiated projects to capitalise on this technology through separate projects i.e. CO_2 separation @ 5 TPD piloting & 500 TPD commercial scale, feasibility study on N_2

Separation from BF gas in collaboration with CSIR and feasibility study Syngas ($CO + H_2$) injection on BF. The Fig. 5 gives us a comparison on the carbon intensity of each technology versus the expected years for its maturity. TGR appears to be a promising technology and needs to be considered to any future expansions.

Gas-based Direct Reduced Iron (DRI)

Direct reduced iron (DRI), also called sponge iron, is produced from the direct reduction of iron ore (in the form of lumps, pellets, or fines) to iron by a reducing gas or elemental carbon produced from natural gas or coal. Critical to this application is the availability of gas network. This technology is at a much higher Technology Readiness Levels and can be quickly implemented, except for the constraint due availability of natural gas/hydrogen infrastructure.

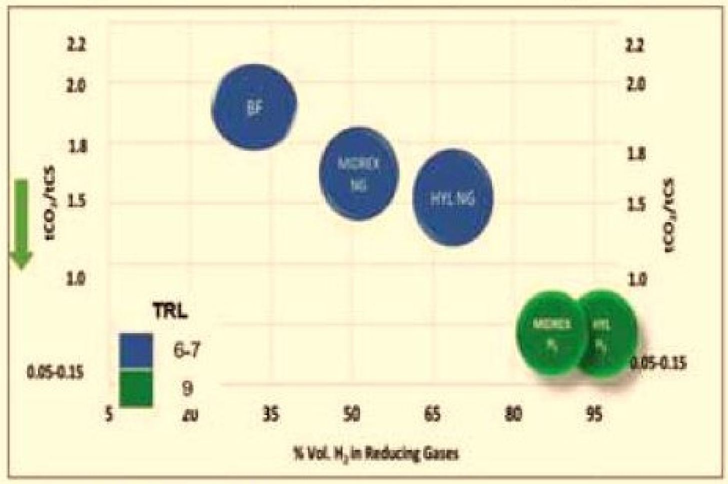

Fig. 6: CO_2 footprint

YBRIT is a recent success story by becoming the first to develop world's first fossil free steelmaking technology with virtually no carbon. ArcelorMittal commissions MIDREX to design demonstration plant for hydrogen-based steel production in Hamburg. Salzgitter AG and Tenova signed a Memorandum of Understanding for the pursuit of SALCOS project for CO_2-reduced Steel Production based on hydrogen. In step with its peers, Tata Steel has also collaborated With HYL and MIDREX: to evaluate TSL iron ore, fuel consumption, operating parameters and with Council of Energy, Environment and Water (CEEW) to gauge future availability and pricing of Natural Gas.

HIsarna

A direct reduced iron process for iron making in which iron ore is processed almost directly into liquid iron (pig iron).

Advantages of HIsarna:

- Sinter plant, pellet and coke plant not needed-lower land footprint and CAPEX
- CO_2 enriched flue gas enabling capture readiness:

Possibility to reduce CO_2 emissions by 80% when coupled with CCU/S

- Lower SOx, Nox, fugitive dust emissions
- Premium steel grades with ultra-low phosphorus
- Plan for executing longer campaigns with steel scrap, biomass and natural gas injection – reduce carbon footprint further
- Enabler for recycling LD slag as fluxing agent

The 0.1 Mtpa rated capacity pilot plant is in operation at IJmuiden and trials are being done for charging scrap and biomass. Though HIsarna is considered one of the most promising developments in reducing CO_2 emissions from the steel industry, yet it is not one without challenges as enumerated.

- Issues in scaling up from pilot to demo plant-refractory, design aspects, cooling circuit, etc.
- Ongoing cross-functional initiatives for demo plant - CFD modelling, heat and mass balance, design calculations, etc.

Hydrogen – Key to a Low Carbon Economy

Considering 1.5°C or 2°C pathway by 2050, hydrogen would consistently play a critical role as an energy carrier. 18 percent of final consumption to be provided by hydrogen by 2050*, requiring a new zero-carbon hydrogen supply chain to be developed. Demand 8X in ext 30 years from 10 EJ to 78 EJ.

Challenges of Hydrogen

- Low volumetric density
- Safety – a critical issue – combustibility, leakage, toxicity
  Optimal transport & storage will be scenario specific and will be a significant challenge

Seeding initiatives at Tata Steel

- Clean and efficient production solution: Feasibility of chemical looping combustion system within steel industry to produce hydrogen using Blast Furnace gas
- Has partnered with Ohio State University and pilot is expected to be done by 2022

CUS – Vital to Net-Zero

The cement, iron and steel, and chemical sectors emit carbon due to the nature of their industrial processes and have high-temperature heat requirements. They are among the hardest to decarbonise. Several reports conclude that achieving net-zero emissions in industries like these may be impossible and, at best, more expensive without CCS. CCS is one of the most mature and cost-effective options for deep decarbonisation of hard-to-abate industry.

Seeding initiatives at Tata Steel

Carbon Capture:

- Pilot Plan of 5 tons per day (CCU) Jamshedpur is expected to be commissioned by end of FY21
- The CO_2 capture technology pursued is amine-based for the separation of CO_2 from flue gas.
- Collaboration with M/s Carbon Clean Solutions, UK Carbon capture in India can only be viable when coupled with utilisation opportunities, which needs to be explored with academia and other research institutes.

Policy Landscape required to Accelerate this Transition

Creation of global level playing field:

- **Carbon tax:** Sets a price on carbon by defining an explicit tax rate on the carbon content of fossil fuels. Carbon pricing would play an important and fundamental role in the transition to a decarbonised economy for both governments and businesses.
  It can help us to mobilise the financial investments required to stimulate clean technology and market innovation, fuelling new, low-carbon drivers of economic growth. For governments, carbon pricing can also be a source of revenue, which is particularly important in an economic environment of budgetary constraints. Long-term investors can use carbon pricing to analyze the potential impact of climate change policies on their investment portfolios, allowing them to reassess investment strategies and reallocate capital toward low-carbon or climate resilient activities.

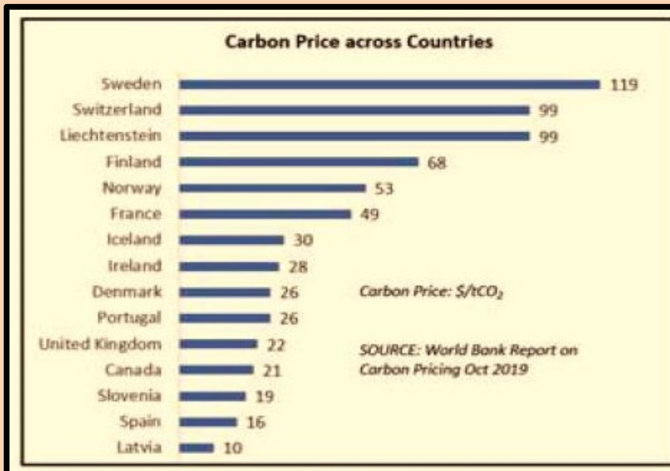

Fig. 7: Carbon Price (>10$)-World Bank

Fig 7 depicts the carbon price across countries (selected few shown)

- **Emissions trading system (ETS):** system where emitters can trade emission units to meet their emission targets by creating supply and demand for emissions units, an ETS establishes a market price for GHG emissions

- **Carbon border adjustment mechanisms:** This mechanism would counteract risk of carbon leakage by putting a carbon price on imports of certain goods from outside

- **Carbon offset:** Carbon offset schemes allow individuals and companies to invest in environmental projects around the world in order to balance out their own carbon footprints.

Policies which encourages:

- **Material Efficiency**: Metric which expresses the degree in which raw materials are consumed, incorporated, or wasted, as compared to previous measures in construction projects or physical processes
- **R&D programme for clean technologies:** Development of technologies to replace fossil fuels with cleaner feedstock i.e. natural gas, hydrogen etc.
- **Collaboration and knowledge sharing:** Collaboration with academia and technology Suppliers
- **Road maps and targets for steel emission reduction:** Reconfiguration/addition of assets with near zero carbon emission intensity
- **Large scale infrastructure development:** Development of viable supply chain infrastructure for natural gas, hydrogen and CCU/S and creation of industry clusters
- Issues with emission related policies
- Uneven policy ambition in different regions may lead to relocation of production capacity - 'carbon leakage'
- Implementation of a uniform international carbon price would be impractical in short or medium term
- An international steel sectoral agreement may be a viable option in a 'low ambition' regime, as a smaller number of players would be involved. Government or companies to commit to 'commonly agreed' upon emission reduction targets (Top 10 countries - 85% steel production; top 50 steel companies- 60% steel production)
- Implementing a 'border carbon adjustment' mechanism by regions having high policy ambition may conflict with WTO& GATT. It is also difficult to track material carbon intensities
- Consumption based regulations would be less politically sensitive, would place the same carbon emission requirement for both, domestic and foreign steel and facilitate cost pass through to final consumer. Challenge - System for tracing carbon content of materials
- International co-operation would facilitate international transfer of technology and provision of concessional finances to enable low emission technology deployment in developing economies.

CONCLUSION

As India embarks on its journey towards 'self-reliance', Tata Steel remains committed to be a reliable and responsible partner in the nation's progress. Building a business that is as relevant and impactful tomorrow as it is today calls for a culture of agility. At Tata Steel, we are leveraging our innovation capabilities, technology leadership and sustainability focus to create long-term value for our stakeholders.

While a young fleet of production facilities presents challenges for reducing emissions, yet growing demand & scrap availability are opportunities to deploy clean technology based on H_2 or/ and CCU/S With strong policy and collaboration across sectors, India could be a leader in clean energy transition in the Iron & Steel sector.

Glossary:

BAT/BPT: Best Available Technology / Best Practises Technology

CEEW: The Council on Energy, Environment and Water (CEEW) is a not-for-profit policy research institution. The Council uses data, integrated analysis, and strategic outreach to explain – and change – like use, reuse, and misuse of resources.

CDQ: Coke Dry Quenching is a heat recovery system to quench red hot coke from a coke oven to a temperature appropriate for transportation and recover the sensible heat of the red hot coke and utilize for power generation or as steam

CCU: Carbon Capture and Utilization

CCS: Carbon Capture and Storage

CSIR: The Council of Scientific and Industrial Research was established by the Government of India as an autonomous research & development body in India

COP21: The 2021 United Nations Climate Change Conference, also known as COP26, is the 26th United Nations Climate Change conference.

ETS: Emissions Trading System (ETS) is to help achieve commitments to limit or reduce greenhouse gas emissions in a cost-effective way

GATT: The General Agreement on Tariffs and Trade is a legal agreement between many countries, whose overall purpose was to promote international trade by reducing or eliminating trade barriers such as tariffs or quotas

IE: The International Energy Agency works with countries around the world to shape energy policies for a secure and sustainable future

IPCC: The Intergovernmental Panel on Climate Change (IPCC) is an intergovernmental body of the United Nations

LCA: Life-cycle assessment or LCA is a methodology for assessing environmental impacts associated with all the stages of the lifecycle of a commercial product, process, or service.

MIDREX & HYL: Midrex is an innovative ironmaking process, developed for the production of direct-reduced iron (DRI) from iron ores and primarily natural gas.

RCP: A Representative Concentration Pathway is a greenhouse gas concentration trajectory adopted by the IPCC.

TRT: Top-Pressure Recovery Turbine Plant generates electric power by employing the heat and pressure of blast furnace top gas to drive a turbine generator

TSJ/TSK: Tata Steel Jamshedpur & Tata Steel Kalinganagar

WTO: The World Trade Organization is an intergovernmental organization that is concerned with the regulation of international trade between nations.

Source: Steel Tech

MEDIUM MANGANESE STEEL: A PROMISING CANDIDATE FOR AUTOMOTIVE APPLICATIONS

Abstract

Over the last decade, research in the field of advanced high strength steels (AHSS) for automotive applications has undergone a paradigm shift from low manganese (Mn) transformation induced plasticity (TRIP) aided and high Mn twinning induced plasticity (TWIP) steels to medium Mn (3-10 wt.% Mn) TRIP and/or TWIP aided steels. This is primarily due to the unique combination of strength and ductility obtained in medium Mn steels. Medium Mn steels represent the 3rdgeneration class of advanced high strength steels (AHSS). These steels supersede the 1st Gen AHSS which shows dismal performance with respect to the requirement of the modern carmakers, at the same time, medium Mn steels are significantly cheaper and are easy to process as compared to the 2nd generation AHSS. These advantages have led to an upsurge in the research of these 3rd Gen AHSS- medium Mn steels since last 10 years. The present article aims to showcase the prowess of medium manganese steels in terms of mechanical performance and therefore its applicability for automotive applications. An overview of composition, suitable heat treatment and the associated parameters, different processing routes, microstructure, mechanical properties and factors influencing it are presented.

Introduction

Major developments on the material for automotive Applications focus primarily on enhancing fuel efficiency and thereby reducing the associated carbon footprint. Such endeavours are directly or indirectly related to materials with high strength to weight ratio, a decent combination of strength and ductility, low cost, easy processing, corrosion and wear-resistance etc. In this regard, steels continue to remain the most dominant material in the automotive industry. Over the years, steelmakers are striving to develop various new grades of steel, which are lighter and stronger. This is required in order to survive the competition being put up by various alternative materials such as aluminum alloys, magnesium alloys, plastics, composites etc. Amidst this competitive environment, steel is still a winner material for the automotive applications as it accounts for about 68% of the vehicle weight. In this regard, the evolution of advanced high strength steels (AHSS) has a major role to play. Various grades of AHSS have kept steel in the competition and as of now, it seems impossible to replace steels from various components of a vehicle. AHSS is the upgraded version of high strength steels (HSS). As per the WorldAutoSteel, "HSS and AHSS are parts of steel family that share common behaviours. In general, AHSS differs from various HSS (such as IF, BH, HSLA) in the sense that the former was developed for increased strength and decent ductility in order to achieve enhanced formability. There is no discrete distinction between the strengths of HSS and AHSS, rather these steels fall into a continuum of strengths. For the sake of definition, steels with yield strength (YS) levels in the range of 210 to 550 MPa are termed as HSS and anything stronger as AHSS."

1. Evolution of AHSS

AHSS is a class of steel that covers a wide spectrum of steel grades differing in composition, processing, microstructure and properties. Accordingly, different grades of AHSS can be found to be a part of the vehicle depending upon the suitability of their usage. AHSS constitutes a significant part of the body in white (BIW) components of a car. AHSS has evolved from 1stgeneration (Gen) to 3rd Gen over the years. The 1st Gen AHSS primarily includes dual phase (DP) steels, martensitic steels, transformation induced plasticity (TRIP) aided steels, ferrite-bainite (FB) steel etc. With the strength levels of ~ 400-600 MPa and ductility ~ 10-20%, the 1st Gen steel lacks the strength-ductility combination as required by modern carmakers in the context of ever-increasing safety standards of the passenger. Such caveats in the 1st Gen AHSS and further stringent safety demands led to the development of 2nd Gen AHSS. 2nd Gen AHSS are basically high manganese(Mn) (>15-20 wt.% Mn) TRIP or/and twinning induced plasticity (TWIP) steels. Such steel possesses an excellent combination of strength and ductility with uniform strength as high as 1500 MPa along with uniform elongation greater than 50 %.In one hand, the 2nd Gen AHSS exhibit an excellent balance of strength and ductility, on the other hand, this grade of steel suffer major limitations such as extremely high production cost as well as difficult processing, both related to their high Mn content. Additionally, the 2nd Gen grade steels suffer weldability issues, again due to heavy alloying. These factors have certainly hampered the mass production and industrial utilization of TWIP steel and therefore these are not the first choice of budget carmakers. Over the prevailing situation of under performance by the 1st Gen AHSS and high cost of 2nd Gen AHSS, there was a need for further development of some grade of steel which has properties at par with the requirement of modern car safety standards as well as comes at low cost. In the pursuit of this development, AHSS evolved to its 3rd Gen grades which include medium Mn steels, quench and partition (Q&P) steels, -TRIP steels etc. Medium Mn steels being one of the important part of 3rd Gen AHSS has been seen as a prospective BIW material. These steels have been the topic of discussion since its inception as these steel if processed suitably can overcome the so-called strength ductility trade-off at the same time keeping a check to the cost of the steel. In the following section, detailed discussion on the medium Mn steel, the interrelation between the composition, suitable heat-treatment and the associated parameters, microstructure and final mechanical properties will be done.

2. Medium Manganese Steel

Medium Mn steels are said to be the ones having Mn concentration in the range of 3-10 wt. % along with other alloying elements such as C, Al, Si. Medium Mn steels are such processed that the final microstructure possesses a significant amount of retained austenite, generally greater than 15-20 volume %. The other major phases being intercritical ferrite and martensite. The simplest way to stabilize austenite phase (i.e. the retained austenite) is to isothermally hold the steel specimen in the inter-critical phase-field (i.e. between Ac_1 and Ac_3) after the homogenization treatment, followed by cooling, but this process would give a rather soft large-grained ferrite matrix and retained austenite. The schematic of the above mentioned heat treatment is depicted in the Figure 1 (a). The large grain sized ferrite phase would certainly limit the mechanical properties that could have been achieved with the grained microstructure (like that of martensite) along with the required amount of soft austenite phase in-between. The superfine rained austenite-ferrite/martensite duplex structure can be alternatively obtained by intercritical heat treatment of the martensitic structure (obtained by hot rolling and subsequent quenching) through the so called austenite reverted transformation (simply called as ART annealing). There are two types of ART annealing treatment done for austenite stabilization at room temperatures. The first one is intercritical tempering, in which the fully martensitic steel specimen is held at the temperature just above Ac1, i.e. in the lower part of the two phase region for a prolonged duration, and subsequently cooling to room temperature (Figure 1 (b)). The second route is intercritical annealing, in which the steel is held at just below the Ac_3 temperature, i.e. in the upper part of the two-phase region (Figure 1 (c)). Both the inter-critical tempering and intercritical annealing treatments would result in retained austenite stabilization. The retained austenite stabilization process is the result of the partitioning of the solute elements such as C and Mn from the intercritical ferrite to the intercritical austenite phase during the holding of the steel specimen at the intercritical temperature. These solute elements being austenite stabilizer, stabilizes the austenite phase and at the same time decreases the martensitic start (Ms) temperature of the intercritical austenite phase. Therefore, a part of the intercritical austenite phase gets retained in the microstructure after the final quenching treatment. However, both the cases suffer the major drawback of retention of a too small amount of austenite phase. In the case of intercritical tempering, the amount of intercritical austenite to be enriched with the solute elements is too low and hence, the amount of retained austenite is low as well. On the other hand, during the intercritical annealing at a temperature just below the Ac3, only small amount of intercritical ferrite is present in the microstructure and austenite in this case, gets little source (ferrite phase) of solute enrichment and thus after cooling to room temperature, most of the austenite get transformed to martensite. These limitations of the two processes suggest that there must be an intercritical temperature at which, when the steel specimen will be held, can fetch the maximum amount of retained austenite (Figure 1 (d)). The schematic of microstructural evolution during the intercritical heat treatment is also presented in Figure 1. It is evident from the schematic that it is desirable to obtain retained austenite in the inter-lath regions of the martensite phase. Figure 2 presents the microstructure of a Fe-5Mn-0.2C steel microstructure, before and after the intercritical heat treatment. The initial fully martensitic microstructure (Figure 2 (a)) evolved into martensite and retained austenite (Figure-2 (b)). This ultrafine microstructure can provide great strength, along with that the required ductility is achieved by the presence of retained austenite in between the martensite/ferrite laths. Apart from the ultrafine microstructure, maximization of retained austenite volume fraction is the primary aim when one requires to obtain the best strength-ductility combination. Therefore, the next pertinent question is what should be the correct intercritical temperature which would fetch the maximum retained austenite in the microstructure and the subsequent question is how to determine that particular temperature. One way, though rigorous, would be to perform the actual heat

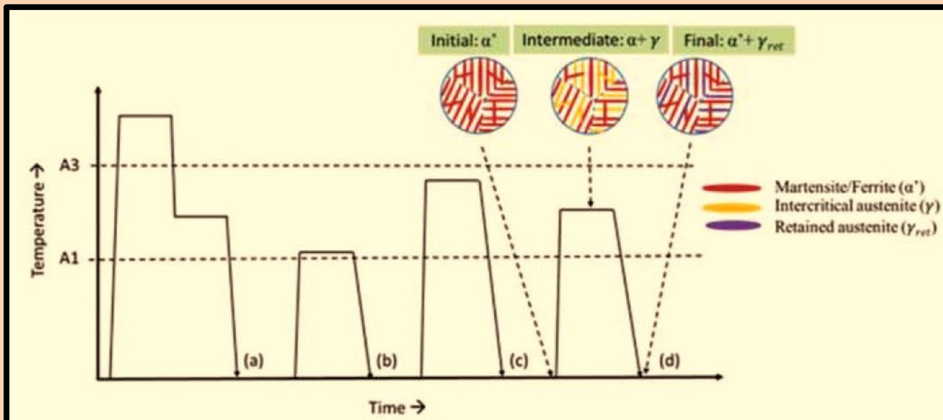

Fig.1: Various heat treatment routes of medium Mn steel

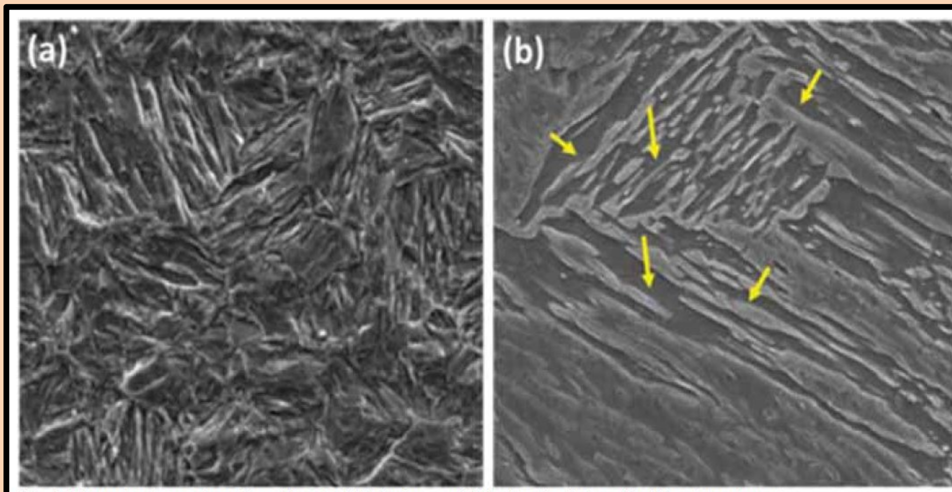

Fig. 2:Microstructure of medium Mn steel (a) before and (b) after the intercritical heat treatment

treatment at some interval of intercritical temperature and then to measure the retained austenite using some suitable technique such as x-ray diffraction (XRD). Given the intensive nature of this procedure, it is not encouraged. Rather, a simple thermodynamic model developed by moor et al. has been extensively utilized by the research community to predict the amount of retained austenite in the final microstructure. The model is described in the following section.

2.1. Thermodynamic model for prediction of retained austenite

In the following, the working steps of the model is discussed taking the example of a simplistic medium Mn composition Fe-5Mn-0.18C-0.5Si-0.5Al (all in wt. %). The required thermodynamic information is obtained from the thermodynamic package Thermo-CalcTM. The approach consists of the following steps:

(i) Prediction of equilibrium amounts of phases as a function of temperature. For this, ThermoCalc program was used and phase fraction evolution with respect to temperature was obtained (Figure 3 (a)).

(ii) Prediction of austenite compositions with respect to temperature, assuming equilibrium condition. Again, ThermoCalc program was employed for the prediction. Equilibrium composition of the austenite phase would be different for different intercritical holding temperature, which is shown in Figure 3 (b&c).

(iii) Using the composition of the austenite phase, predicted above by ThermoCalc, the martensitic start (Ms) temperature was obtained by using the following formula:

$$Ms= 539 - 423*\%C - 30.9*\% Mn - 7.5*\%Si + 30*\%Al \quad (i)$$

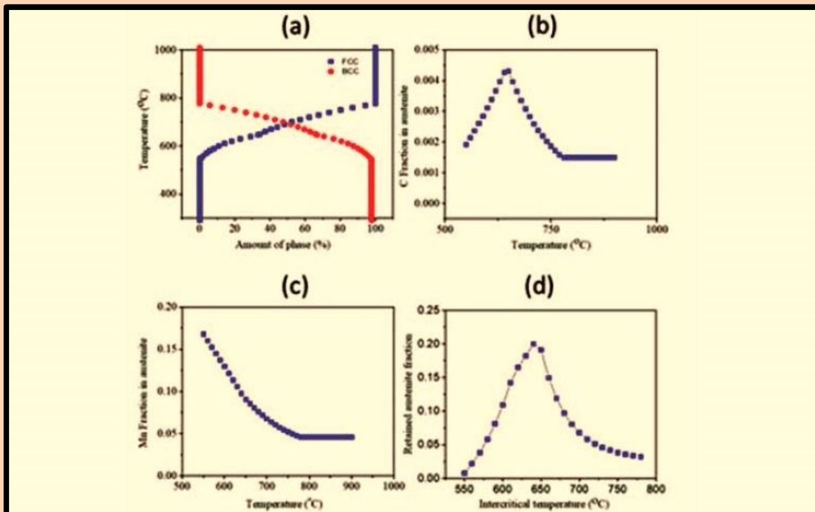

Fig. 3: (a) Evolution of phase fraction with increasing temperature, (b) Carbon, (c) Manganese and (d) variation of Retained austenite as a function of intercritical holding temperature

Ms temperature would vary with intercritical holding temperature as the solute content of austenite phase was varying with intercritical holding temperature and the Ms temperature depends upon the solute content as per the above equation. The amount of martensite which would form after quenching the sample to room temperature, initially held at some intercritical temperature was estimated using the famous empirical Koistinen-Marburger (KM) equation:

$$f_m=1-\exp(-0.011(Ms-QT)) \quad (ii)$$

Where, Ms is the martensitic start temperature and QT s the final quenching temperature.

(iv) Subtracting the amount of fresh martensite Predicted to form upon final quenching from the ausenite would give the final retained austenite fraction in the microstructure at room temperature (Figure 3 (d)).

2.2. Factors affecting retained austenite fraction

It is clear from the above exercise of prediction of the fraction of retained austenite that the same is dependent on various factors such as the intercritical annealing temperature and alloy composition. It is to be noted that the above exercise does not take into account the kinetics of the elemental partitioning during the intercritical holding treatment. In actual practice, it takes a certain amount of time to reach the equilibrium condition, which depends on various microstructural factors such as initial state of the alloy (forged, hot rolled or cold rolled), initial microstructural constituent, annealing temperature etc. In the following section, the various factors affecting the amount of retained austenite in the final microstructure will be discussed.

(i) **Alloy Composition:** It is very clear from the above mentioned model calculation that the austenite stabilizer elements (C, Mn) has the major role to play for the stabilization of retained austenite. These elements partition to the intercritical austenite phase during the intercritical holding and thereby decreases the Ms temperature of that austenite (see equation (i)). This way the retention of austenite becomes possible. It is therefore straight forward that increasing the concentration of the alloying elements like C and Mn will help in austenite stabilization. However, increasing the C content in the alloy also increases the cementite phase field and therefore care must be taken during the intercritical annealing treatment in order to avoid the cementite phase. In this regard, Si and Al additions are done in order to avoid the cementite precipitation and keep the C and Mn free to be available for the partitioning to the austenite phase. Al addition comes with an added advantage of increasing the Ac1 and Ac3temperatures and hence the intercritical temperature for the heat treatment also increases. The higher intercritical temperature facilitates increased kinetics of partitioning and less time is required for reaching the equilibrium. Additionally, Al addition will lead to decrease in the density of the alloy. However, care must be taken during steel making process for Al addition, as Al addition leads to detrimental nitrides and oxides inclusions in the steel.

(ii) **Intercritical Temperature:** The intercritical heat treatment temperature needs to be appropriate such that during the heat treatment optimum amount of intercritical austenite and intercritical ferrite are formed. The amount of intercritical ferrite phase decides the amount of alloying elements available for partitioning to the austenite phase. Additionally, the intercritical annealing temperature should be carefully chosen in order to avoid the formation of other carbides and intermetallics.

(iii) **Intercritical Annealing Time:** The kinetics of austenite phase evolution during the intercritical holding and the subsequent partitioning of elements is highly dependent on various associated factors such as the initial microstructure and initial state of the specimen (hot rolled or cold rolled). One of the aim is to maximize the amount of retained austenite in the final microstructure and the amount of retained austenite is dependent on the amount of intercritical austenite, the amount of elemental partitioning, the morphological evolution of the intercritical austenite etc. All these above factors are time dependent phenomena and directly influence the retained austenite content in the final microstructure. It is therefore important to carry out the intercritical annealing treatment for a suitable time duration in which the above time dependent factors could be well taken into account.

2.3. Structure – Property Correlation

Medium Mn steels have been seen as a suitable candidate for various parts of BIW of automobiles. This is primarily due to the superior mechanical properties which could be achieved in such steels. In the earlier sections, a detailed discussion has been made on the correct microstructure, the required heat treatment procedure to obtain the same and the factors on which the evolution of the correct microstructure depends. In this section, an interrelation between the microstructure and the mechanical properties has been discussed. Various reviews on medium Mn steel showcased the superiority of tensile properties being exhibited by these alloys in comparison to the 1st Gen AHSS grades (Figure 4). Further, Medium Mn steels are not far behind the 2nd Gen AHSS in terms of strength or ductility, with an added advantage of relatively very low alloying content and thus low in cost and relatively easy processing. Medium Mn steels can have tensile strength as high as 1200-1500 MPa and can possess a ductility greater than 50%. The high strength in such alloys is the direct consequence of ultrafine microstructure with the martensite/ferrite laths and the austenite film thicknesses in the order of ~200-500 nm. The austenite phase embedded in between the laths of martensite/ferrite provides the required ductility. A scatter in the properties of medium Mn steel in Figure 4 is associated with the vast range of austenite composition being tried with variation in the amount of retained austenite and differences in the sizes and morphologies of the phase constituents. In general, the lower the lath thicknesses, the greater will be the strength. The evolution of lath thicknesses in turn is dependent on various factors such as the initial martensite lath thickness i.e. before the intercritical heat treatment, the prior austenite grain size etc. In addition, the amount of alloying elements also directly influences the strength of the alloy as a part of solid solution strengthening. The ductility is mainly guided by the retained austenite present in the microstructure. It is generally accepted that, greater the amount of retained austenite in the microstructure, higher will be its ductility as austenite being face centered cubic crystal structure which is a close packed structure having a large number of slip systems and thus can be deformed easily. This is true but there is an extension to this theory. Apart from slip, the austenite phase can also deform via twinning and/or martensitic transformation. Both the twin and martensitic transformation are known to provide exceptional work hardening during the deformation and the associated phenomena are commonly known as TWIP and TRIP effects, respectively. Therefore, the presence of austenite not only can provide ductility but can contribute significantly to the strength of the alloy as well. The onset of TRIP or TWIP effect is dependent on the stacking fault energy (SFE) of the austenite phase. It has been found that the austenite phase with SFE less than 18-20 mJ/m^2 deform primarily via TRIP effect, while TWIP effect is prominent in the austenite phase having SFE in between 20-45 mJ/m^2. Austenite phase with SFE greater than 45 mJ/m^2 deforms via slip. TWIP effect is known to exhibit superior work hardening effect during the deformation. Therefore, SFE of the steel should be such, that it could provide progressively high work hardening during deformation. SFE of the austenite phase can be tuned to suit the mechanical property requirement as it depends on austenite composition, morphology, grain-size and temperature. From the present section, it becomes clear that the mechanical properties of the medium Mn steels are tuneable as per the end requirement. This can be done by tuning various microstructural parameters.

2.4. Current status and prospect

Despite the advantages of medium Mn steel over the First generation and second generation steels, these steels find restricted use till now because of several Limitations. First, the requirement of significant alloying content increases the cost of production as well as poses manufacturing challenges in industrial scales. Production of medium Mn steels requires special liquid steel making practices to control the level of phosphorus, sulphur and nitrogen in steel and thereby minimize the inclusions especially MnS. Ca treatment can be suitably applied during the secondary

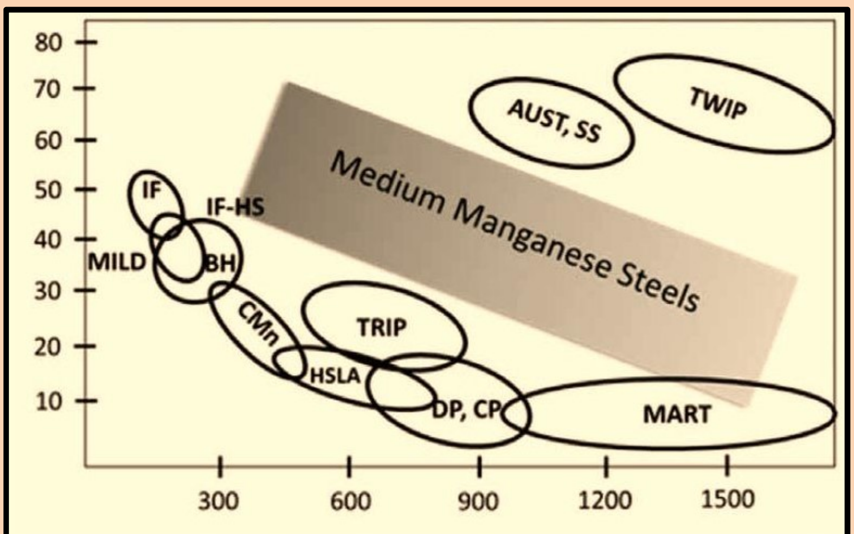

Fig. 4: Schematic of tensile strength – elongation map for medium Mn steels, superimposed on the strength – elongation map for automotive steel grades

steel making stage to improve steel casting ability, minimized slab surface defects arising from inclusions and modify the sulphide inclusion morphology to improve its compatibility with the matrix during hot rolling. The cold rolling of these steel also poses challenges like achieving the desired dimension (width, thickness, flatness) as the steels exhibit higher cold strain hardening and there is a risk of cold roll cracks at higher reduction rates. However, with the optimization of cold rolling schedules especially reduction rates at each pass and suitable lubrication, higher thickness reduction can be achieved.

In regard to the coating, because of its high Mn, Al and Si content, there are problems of selective oxidation during annealing treatment. However, using a suitable annealing atmosphere (N_2 and H_2) and dew point control, the extent of selective oxidation can be reduced to ensure good coatability. During the forming stage of medium Mn steel, one of the severe difficulties encountered is the high spring-back effect, due to their high strength. Several investigations are ongoing in this direction to understand the formability and bending ability of these steels. While medium Mn steels offer superior mechanical properties, it requires specialized welding techniques for its application in automotive structure. The heat produced during welding alters the microstructure of the base material and therefore the mechanical properties. Advanced welding techniques like resistance spot welding and laser welding have emerged recently to join AHSS without much alteration in the properties.

Regardless of the above stated caveats which can be addressed by applying respective specialized techniques, the requirement of lighter and safer vehicles will drive the development of medium Mn steels design philosophy. The design of new generation medium Mn steel also takes into consideration the lowering of the density of the alloys, by addition of a substantial amount of light elements like Al in range of 3-12 wt.%. With every 1% addition of Al, there is a decrease in density of 1.3% and a reduction in bulk density of 5-15% can be achieved in medium Mn high Al steels.

The Al added low-density medium steel gives an additional weight saving opportunity and a consequent reduction in fuel consumption and emissions. The mechanical properties obtained in these steel are quite outstanding, having a product of strength-elongation in the range of 40-70 GPa%. Keeping in view the stringent vehicle safety regulations and environmental norms to reduce emission, the requirement for medium Mn high strength low-density steels will continue to rise in the coming future. The strong demand for energy saving is considered to lead the change in automotive power train from internal combustion engines to HEVs (Hybrid Electric Vehicles), EVs (Electric Vehicles) and FCVs (Fuel Cell Vehicles). Crashworthiness will be one of the key performances of automobiles even though advances in automation/sensor technologies to avoid traffic accidents. These technologies can be effective only when the automation/sensor and material manufacturing industries work together from the beginning of the new development.

Source: Steel Tech

STEEL COMPANIES LIKELY TO ADD 29 MILLION TONNES CAPACITY IN FIVE YEARS

Steel companies are looking to restart expansion projects on the back of surging steel prices. In the next five years, about 29 million tonnes capacity is likely to be added, with most of it expected by FY2024. JSW Steel is looking to add 14.8 million tonnes across Dolvi (Maharashtra), Vijaynagar (Karnataka) and at Bhushan Power & Steel facility in Jharsuguda (Odisha). Tata Steel has restarted its five million tonne expansion project at Kalinganagar (Odisha). Jindal Steel & Power (JSPL) is looking to add 6 million tonnes at Angul (Odisha). Additionally, NMDC's Nagarnar Steel Plant, is expected to commission its three million tonne greenfield steel plant. All put, the expansion projects add up to about 29 million tonnes.

JSW Steel's Vijaynagar plant is at 12 million tonnes. Seshagiri Rao, joint managing and group chief financial officer, JSW Steel, said that the hot metal capacity at four units at Vijaynagar was being expanded, which will give one million tonne of extra capacity. That will happen this year. A five million tonne expansion at Vijaynagar, approved by the board, will be commissioned in March 2024, at a capex cost of Rs 15,000 crore. The revamp of a blast furnace at the location will add another 1.5 million tonne. "That project was put on hold because we wanted to take a shutdown after Dolvi expansion. Once Dolvi happens, it can come in," Rao said.

The expansion at Vijayanagar will take the capacity at the location to 19.5 million tonne by 2024. The commissioning of Dolvi expansion by 5 million tonne – which got delayed due to the second wave of Covid-19 - is expected to happen by the end of September. Also, there are plans to increase Bhushan Power & Steel's capacity to five million tonnes from 2.7 million in three years.

The country's other private sector steel major, Tata Steel, recently said that it had restarted its 5 million tonne expansion project at Kaliganagar (Odisha), expected to be completed in FY24. Jindal Steel & Power, too, said that it would expand capacity from six million tonnes to 12 million tonnes at Angul (Odisha), which would take its overall steel capacity to 16 million tonnes in India. The capex is pegged at Rs 18,000 crore. V R Sharma, managing director, JSPL said that three million tonnes expansion would be commissioned by end-2023 or 2024 and the balance three million tonne by end-2025 or 2026.

He said, steel capacity would have to be augmented for India to achieve 300 million tonnes capacity. For the past one year, steel prices have been on an uptrend, touching record levels. Jayanta Roy, senior vice president, ICRA, said, that the upturn in the steel industry has continued unabated since the second quarter of FY 2021, leading to strong cashflows of players. "With a better financial health, leading companies are now better placed to undertake expansion projects than they were in the past several years," said Roy.

Major steel companies used the current cycle to deleverage and strengthen the balance sheet. Tata Steel's net debt fell by Rs 29,390 crore to Rs 75,389 crore in FY21; JSPL saw consolidated net debt reduced by Rs 13,773 crore in FY21 and government-owned SAIL reduced gross debt by around Rs 16,150 crore to Rs 35,330 crore (provisional) as on March 2021. JSW reduced Rs 858 crore in debt after a cash-spend of Rs 15,000 crore in organic and inorganic growth last year.

Roy pointed out that in the next five years, domestic steel companies will be adding about 30 million tonne capacity, which is about 25-30 per cent of the current domestic consumption. "That should largely address any apprehension of steel shortage in India," he added. India's capacity for domestic crude steel expanded from 128.27 million tonne in 2016 to 142.72 million tonne in 2020. However, Sharma said, with many small plants shut, effective capacity would be 120-125 million tonnes.

Source: Business Standard

STEELMAKERS TO REPORT BETTER EARNINGS AND IMPROVE UTILIZATION IN H2 OF FY22: ANALYSTS

Indian steelmakers are likely to witness better earnings and capacity utilisation levels in the coming quarters of FY 22 mainly on account of buoyant steel prices which touched record high levels despite weak domestic demand in the first quarter due to the second wave of the pandemic. "Despite weak domestic demand, buoyant international demand and steel prices supported the domestic steelmakers and India remained a net exporter of steel with 122% Y-o-Y growth in exports reported in April 2021," rating agency ICRA said in a report recently.

While the ongoing second wave of the pandemic has caused the demand outlook to continue to be weak and uncertain in H1FY22, it is expected to spike in H2 FY22 on account of a revival in the construction and real estate sectors, green shoots in which are already visible, said Brickwork Ratings in a report titled 'Drishtikone'.

As per analysts from ICRA, the second wave of the pandemic has hit domestic steel demand in the current year, with a 22% month-on-month drop in April 2021, and a further 1% sequential decline reported in May 2021. However, the current year consumption data looks far better compared to last year which is a 150% growth in April-May 2021 because of the much more stringent lockdowns observed during April-May 2020.

With the gradual lifting of lockdowns/mobility restrictions in India in June 2021 and improving vaccination coverage, ICRA expects domestic demand to recover in the coming months, which in turn would result in a pick-up in capacity utilisation levels. In April 2021, the steel prices saw an uptrend when the Hot/Cold Rolled Coil (HRC/CRC) prices in Mumbai were revised upwards by around Rs 5000/- per tonne, thus touching a record high of around Rs 70,000 and 83,000 per tonne, respectively.
Domestic flat-steel prices have nearly doubled to Rs 72,000 per tonne in June 2021 from Rs

38,000 per tonne in June 2020. In comparison, long-steel prices rose 1.4 times to Rs 57,900 per tonne. The reasons are said to be the higher prices of raw material globally and lower exports from China, the largest steel producer.

“Domestic steel prices are still at around a 20%-25% discount to the international price and are around 15%-20% lower than the landed cost of imported steel. Domestic steel players continue to remain optimistic about the increase in steel prices in future as well,” said Brickwork Ratings in a report.

Analysts expect the demand in the auto sector to rise in the festival season in the second half. “Steel producers worldwide will achieve a substantially improved operating performance and strong free cash flow based on significantly higher volumes and prices,” said rating agency Moody’s Investors Service in a research report titled ‘Metals & Mining – Cross Region.

Analysts from Moody’s expect steel supply to ramp up as productivity improves and new capacity comes online in certain regions of the world. “Steel prices in 2021 will settle well above historical levels supported by increased demand, higher prices for raw material inputs including iron ore,” Moody’s report said.

Taking advantage of the steel cycle, large steelmakers either planned for further capacity expansions or deleveraged substantially. “With steel prices reaching all-time high levels in the current fiscal, and industry capacity utilisation levels being expected to inch higher towards 80% in FY2022, leading steel producers, over the past one month, have announced large CAPEX plans accumulating to 31 mtpa,” said ICRA in its report.

This would entail sizeable investments of Rs. 76,500 crore spanning the next 3-4 years. Consequently, the industry’s leverage metrics are expected to moderate from FY2023 as capital deployment for fresh capacity creation gathers pace, the report added. The top 4 steelmakers, Tata Steel JSPL, JSW Steel and SAIL reduced net debt (in their Indian operations) by Rs 34,000-35,000 crore as their Ebitda pool nearly doubled during the year, said rating agency Crisil in a sector report.

“This fiscal, deleveraged balance sheets will drive capacity expansion plans (both brownfield and greenfield) and CAPEX to their previous peaks,” the report said adding that the Capex deferred during the previous cycle will also kick in. “The ongoing CAPEX cycle will continue to be driven by large steelmakers, which are expected to add more than 95% of the new capacities coming on stream over the medium term,” Crisil’s report said.

However, analysts expect the steel prices to soften in the second half of FY21 globally, but the Indian steel prices would still be quoting high as compared to the levels of FY 19-20. “The price rally, spurred by China’s green policy, is likely to benefit through the first half of this fiscal, too, with flat steel prices already up 70% since April. While prices will soften in the second half, they would still be 40-45% higher on-year," said Crisil in its report.

Moody's in its research report said that the worldwide supply/demand imbalance for steel will persist, with prices gradually declining toward their historical averages. "Worldwide demand will ebb as customers replenish inventories and stimulus dollars wane and vaccinations allow more consumers to return to spending on experiences rather than material goods," the report added.

Source: The Economic Times

MSME ENGINEERING EXPORTERS SEEK PM'S INTERVENTION ON RISING STEEL PRICES

Engineering exporters in the MSME segment have sought Prime Minister Narendra Modi's intervention on rising steel prices, stating that the industry needs the alloy and other inputs at affordable rates so that export competitiveness of value-added products is maintained in the global markets. In a letter to the prime minister, Ludhiana Hand Tools Association President S C Ralhan said that many of the competing countries, particularly China, provide support to manufacturing units by providing steel and other inputs at much reasonable prices to boost competitiveness of their engineering sector in the global markets.

He said that India is gradually losing out its markets to China in the value-added segment of exports and the recent growth visible in exports is largely on account of hike in the prices of metal and commodities. A sharp decline is seen in the export trends of finished engineering goods, he said. "In the given situation, the MSME (micro, small and medium enterprises) industry needs to be provided steel at reasonable prices so that export competitiveness of value-added products is maintained," Ralhan said in his letter.

He cautioned that if the prices would not come under control, a large number of manufacturers would be out of business and that could result in closure of factories, loss of employment. He suggested the government consider setting up a raw material bank for MSMEs to provide steel and other key inputs to them by extending some kind of subsidy.

"An immediate decision is needed particularly as continuance of pandemic in the country has already resulted in closure of large number of MSMEs which will further increase, if immediate steps are not taken to provide steel to them at most competitive price," he added.

Source: www.economictimes.indiatimes.com

LARGE STEEL MILLS GROW LARGER ON IMPROVED SUPPLY-CHAIN EFFICIENCIES: CRISIL

Large steel makers took huge strides in terms of both operations and financial performance last fiscal, increasing their market share by 500 basis points (bps) on-year to 58 per cent despite their share of industry capacity remaining unchanged, said a Crisil report recently. The improvement was driven by supply-chain efficiencies, higher exports, and captive mines that limited the impact of iron ore shortage, said the report. Their capacity share is expected to increase this fiscal in FY22 after Sajjan Jindal-led Dolvi plant expansion of 5.6 million tonne comes on stream. Higher exports helped counter lacklustre domestic demand for large steel makers (especially in the closing quarter of last fiscal and the first quarter of FY22).

They also gained domestic market share, especially in the long-steel space, said the report. Consequently, players operated at more than 80 per cent utilisation levels as against sub-optimum levels of 62 per cent by midsized and small steel makers. Large steel makers also benefited more from the rally in steel prices, given the dominance of flat steel in their portfolio. Domestic flat-steel prices have nearly doubled to Rs 72,000 per tonne in June 2021 from Rs 38,000 per tonne in June 2020. In comparison, long-steel prices rose 1.4 times to Rs 57,900 per tonne in the period under review. The price rally, spurred by China's green policy, is likely to benefit through the first half of this fiscal, too, with flat steel prices already up 70 per cent since April. While prices will soften in the second half, they would still be 40-45 per cent higher on-year, said the report.

Trend Analysis of different Steel Prices of March 2020 to January 2021 (Rs per Tonne)

Items	March 2020	April 2020	May 2020	June 2020	July 2020	Aug 2020	Sept 2020	Oct 2020	Nov 2020	Dec 2020	Jan 2021
Hot Rolled Coil	38200	38200	37250	35800	35650	38125	39500	42000	44250	47000	54500
Hot Rolled Plate	38150	38150	37250	35000	35500	37875	41500	43250	45000	47500	56250
Cold Rolled Coil	43000	43000	42000	40300	40500	43750	47500	52000	53500	55750	63500
Hot Dipped Galvanised Coil	49750	49750	49750	50000	49500	50500	50500	55250	55250	59000	68000
Wire Rod	29300	29300	31100	30000	30200	33100	32900	33500	36300	39400	40000
Sections & Beams	33900	33900	33900	33800	33600	36800	35800	35800	39100	41700	42100
Rebar	33700	33700	34500	32100	30600	32700	33600	34600	37300	41200	43700
Merchant Bar	34800	34800	35000	34600	33500	35200	35900	36300	38700	42200	44700

Source: MEPS

With blockbuster profits, steel makers embarked on significant deleveraging. Consequently, their net debt/EBITDA reduced to 1.8 times last fiscal from 3.6 times in fiscal 2020 (average for the sample set of 21 companies). The top four steel makers reduced net debt (in their Indian operations) by Rs 34,000-35,000 crore as their EBITDA pool nearly doubled during the year. This fiscal, deleveraged balance sheets will drive capacity expansion plans (both brownfield and greenfield) and capex to their previous peaks. Capex deferred during the previous cycle will also kick in. The ongoing capex cycle will continue to be driven by large steel makers, which are expected to add more than 95 per cent of the new capacities coming on stream over the medium term.

Some key capacity expansions by large steelmakers will include the following brownfield additions such as Tata Steel Kalinganagar (5 mtpa), Jindal Steel & Power at Angul (6 mtpa) and JSW Steel Vijayanagar (5 mtpa expansion and 1.5 mtpa blast furnace revamp). However, these capacities are expected to be commissioned in or after FY24.

Source: Business Standard

BAUXITE IMPORT RESULTS INTO RS 390-CR FOREX LOSS FOR INDIA: IIVCC

India's import of bauxite, a raw material used for manufacturing aluminium, has caused a foreign exchange (forex) loss of Rs 390 crore during the April-June period, according to the Indian Industrial Value Chain Collective. The Indian Industrial Value Chain Collective (IIVCC) represents organisations involved in industrial production and consumption supply chain activities across India. "Indian Industrial Value Chain Collective released data recently on the (forex) loss resulting from import activities of bauxite.

"For the first quarter of 2021 (April to June 10), this totals to a staggering USD 51.97 million (Rs 390 crore), which otherwise should have belonged to the people of India, with a significant share going to the participants in the value chain of extraction, transportation, processing and supply of bauxite and its end output," it said in a statement. Despite India having the fifth-largest bauxite deposit in the world with reserves of over 3.8 billion tonnes, aluminium industries continue to rely on imported bauxite, said Abhay Raj Mishra, member of IIVCC and president of Public Response Against Helplessness and Action for Redressal (PRAHAR).

He added that it has caused a forex loss of 571 million dollar (about Rs 4,400 crore) in the past six years. "For every single mine auctioned, there is a potential to garner Rs 5,000 crore for the exchequer and create 10,000 livelihood opportunities. The positive ripple effect that this could have on the socio-economy of the region is significant," he added. Bauxite import has increased 300 per cent in the past six years, according to data published in Import-Export Databank, Ministry of Commerce.

Source: The Economic times

DGTR FOR IMPOSING COUNTERVAILING DUTY ON ALUMINIUM WIRES FROM MALAYSIA

The commerce ministry has recommended the imposition of countervailing duty on certain types of aluminium wires from Malaysia for five years, a move aimed at guarding domestic players from imports that are subsidised by that country. The ministry's investigation arm

Directorate General of Trade Remedies (DGTR) in its findings after a probe stated that imposition of definitive countervailing duty is required to offset subsidisation. "The authority recommends imposition of definitive countervailing duty for a period of five years," DGTR said in a notification.

The authority considers it necessary to recommend imposition of the duty on the imports, it added. The finance ministry takes the final call on imposition of the duty.

The directorate carried out the probe following complaints from Vedanta Ltd and Bharat Aluminium Company Ltd. They had filed a petition on behalf of domestic producers for initiation of anti-subsidy investigation.

DGTR has concluded that the domestic industry has suffered an injury due to subsidized products from Malaysia. It has recommended a duty of 6.87 per cent and 16.5 per cent.

Countervailing duty is a country-specific duty imposed to safeguard the domestic industry against unfair trade subsidies provided by the local governments of the exporting nations. Under the global trade rules of the World Trade Organization (WTO), a member country is allowed to impose anti-subsidy to countervailing duty if a product is subsidized by the government of its trading partner.

These duties are trade remedies to protect domestic industry. Subsidy on a product makes it competitive in price terms in other markets. Countries provide this to boost their exports. In a separate notification, DGTR has informed that it has started a probe into alleged dumping of a chemical - Mon Ethylene Glycols - used to make polyester fibres and polyester films, from Kuwait, Saudi Arabia and the US.

Source: The Economic times