MET-INFO

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Published By
The Indian Institute of Metals
Delhi Chapter
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Inhouse Publication
For Private Circulation Only

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Chapter Activities

The office bearers of IIM Delhi Chapter visited IIT Delhi to promote the membership drive of IIM. The visit evoked positive result.

Our Chapter has been able to enrol 26 persons from IIT Delhi in July/August 2022 as members of IIM. The members include IIT Delhi faculty and students. The details of the 26 members are as under:

Life Members					
Sl	Name	Designation	Sl	Name	Designation
1	Prof. Jayant Jain	Associate Professor	2	Dr. Suresh Neelakantan	Associate Professor
3	Dr. Nitya Nand Gosvami	Associate Professor	4	Dr. Suryanarayana Vikrant Karra	Assistant Professor
5	Dr. Lakshmi Narayan Ramasubramanian	Assistant Professor	6	Ms. Snigdha Priyadarshini	Research Scholar

Ordinary Members					
Sl	Name	Designation	Sl	Name	Designation
1	Dr. Sangeeta Santra	Assistant Professor	2	Dr. Ayan Bhowmik	Assistant Professor
3	Shri Subhakar Mangam	Research Scholar	4	Shri Shivansh Mehrotra	Research Scholar
5	Shri Parnaik Amey Raghuvir	Research Scholar	6	Shri Swagat Mukar Pani	Research Scholar
7	Shri. Abhishek Rastogi		8	Shri Ashwani	
9	Ms. Ayushi Thakur				

Student Members					
Sl	Name	Sl	Name	Sl	Name
1	Ms. Abhigna Kodam	2	Shri Nitin Srivastava	3	Shri Chirag Thapa
4	Shri Jatin Saini	5	Shri Jitendra Soni	6	Shri Surajbhan Jaiswal
7	Ms. Shweta Rani Keshri	8	Shri Syed Junaid	9	Ms. Bushra
10	Ms. Priyanka Saini	11	Ms. R. Rashi		

The Chapter welcome these 26 members to the IIM fold.

This is the first time that as many as 26 members were enrolled IIM membership under Delhi Chapter in a month. We look forward to their support for future activities of IIM Delhi Chapter.

MMMM 2022 Event

The MMMM 2022 event consisting of International Conference and Exhibition was held at Pragati Maidan, New Delhi from 25-27 August 2022. The event was held in collaboration with HYVE (formerly International Trade Exhibitions India Pvt. Ltd). The event was inaugurated by Hon'ble Minister of Civil Aviation and Steel, Shri Jyotiraditya M. Scindia.

The Theme of the Conference was **Resource Efficiency and Circular Economy in Mineral & Metal Sectors"**. The Conference consisted of the Inaugural Session, Panel Discussion, eight Technical Sessions and a Valedictory Session.

The Conference brought together leading technocrats, researchers, designers, consultants, academicians, researchers, and students to exchange and share their views and experiences on this important emerging topic RESOURCE EFFICIENCY &

CIRCULATR ECONOMY IN MINERAL & METAL SECTORS. The Conference provided an interdisciplinary platform which was attended by not only engineers, technologists and scientists in mineral and metal sectors, but also road construction materials specialists, agriculture scientists, recycling specialists and energy specialists.

In this two and half days of conference, there were 42 presentations, 21 from Industries, 9 from internationally reputed technology and equipment suppliers, 6 from national labs. and 6 from design and consultancy organization. The event brought together more than 200 delegates.

Experts in Minerals and Metals Sector participated in Panel Discussion, which was presided over by Ms Ruchika Chaudhry Govil, Addl Secretary, Min of Steel.

40 papers were presented in the Conference under 8 technical sessions. The papers touched upon the subjects relating to the following:

(a) Resource Efficiency and Circular Economy in Metal Sector
(b) Decarbonisation and Green Steel Production
(c) Manufactures and Exhibitors Presentation

(d) Utilization of Slag and Co-Products
(e) Utilization of Lean Grade Ores
(f) Energy and Environment
(g) New Technology
(h) Industry View on Resource Efficiency and Circular Economy

Out of the 42 papers a compendium of selected 20 papers was published. A Souvenir consisting of the messages from various dignitaries and abstracts of the papers was published. Compendium of Selected papers and Souvenir were released by the Hon'ble Minister. A copy of the Souvenir and Compendium was distributed to the delegates and dignitaries of the Conference.

The Conference was attended by about 200 delegates.

The Valedictory Session of the Conference was presided over by Shri Parmjeet Singh, Addl. Industrial Adviser, Ministry of Steel on 27.8.2022.

Awards were distributed to the selected exhibitors. Mementoes were also given away to the sponsors of the Conference.

The Conference was supported by following Organizations:

(a) JSW Steel

(b) Tata Steel

(c) SMS India

(d) Danieli India

(e) Danieli Corus

(f) SAIL

(g) MIDHANI

(h) AM & NS

(i) MECON

(j) RHI Magnesite

(k) Star Wire

(l) Proman Infrastructure

(m) Vedanta

(n) TAKRAF

(o) Kashi Vishwanath Steels

Recognition and Award

Congratulations

Dr. Ramen Datta, Secretary, IIM Delhi Chapter and Consultant, Steel Research & Technology Mission of India (SRTMI) has been conferred **"IIM Fellowship"** for his outstanding contributions to the steel industry and commendable efforts made by him towards promotion of IIM activities over the last 40 years.

Dr. Datta functioned as Secretary of Ferrous Division (2006-09) and served as the Joint Secretary of IIM during 2009-10. He also served as Editor of Transactions, IIM during 2000-03. He has played a key role in the organisation of a number of NMD/ATM Conferences over the last 4 decades.

The Fellowship Plaque will be conferred to him on 14th November 2022 during the IIM Awards Ceremony at Hyderabad.

World Crude Steel Production : January – June 2022

	million tonnes		million tonnes	
	June 2022	% change Jun-22/21	Jan - Jun 2022	% change Jan - Jun 22/21
Africa	1.2	-18.7	7.3	-9.1
Asia and Oceania	118.8	-3.1	701.4	-4.8
EU (27)	11.8	-12.2	73.8	-6.2
Europe, Other	3.8	-10.9	24.0	-5.0
Middle East	3.4	-5.0	20.4	-5.9
North America	9.6	-2.4	57.2	-2.3
Russia & other CIS + Ukraine	5.9	-34.3	43.6	-18.0
South America	3.7	-4.9	21.8	-2.8
Total 64 countries	**158.1**	**-5.9**	**949.4**	**-5.5**

Top 10 Steel Producing Countries

Countries	June 2022 (million tonnes)	% change Jun-22/21	Jan - Jun 2022 (million tonnes)	% change Jan - Jun 22/21
China	90.7	-3.3	526.9	-6.5
India	10.0	6.3	63.2	8.8
Japan	7.4	-8.1	46.0	-4.3
United States	6.9	-4.2	41.1	-2.2
Russia	5.0 e	-22.2	35.4	-7.2
South Korea	5.6 e	-6.0	33.8	-3.9
Germany	3.2	-7.0	19.6	-5.5
Turkey	2.9	-13.1	19.0	-4.6
Brazil	2.9 e	-6.1	17.4	-2.9
Iran	2.2 e	-10.8	13.6	-10.8

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

Source: WSA Press Release 22nd July 2022

SteelZero Launches in India

International non-profit Climate Group, in partnership with ResponsibleSteel, has launched SteelZero in India, a global initiative that brings together leading organisations to speed up the transition to a net zero steel industry.

Emissions from India's steel industry are projected to triple over the next three decades, according to the International Energy Authority. The country's push to meet its net zero targets will rely heavily on the decarbonisation of its steel sector. SteelZero brings together businesses across the steel industry to make a public commitment to buy and use 50% low emission steel by 2030, setting a clear pathway to using 100% net zero steel by 2050.

In the coming months, Climate Group will launch a Net Zero Steel Demand Outlook report based on the Indian steel demand landscape. Companies will then be invited to join working groups for individual steel-using sectors with the objective of supporting them in adopting net zero or low carbon steel. Climate Group will also publish an insights report for each identified sector resulting from the working group discussions.

Source: Steel Times International Weekly News, 15th July 2022

Capturing Carbon Dioxide from the Air and Storing in Concrete

University of Illinois will lead the front-end engineering design study at U. S. Steel's Gary Works in Gary, Indiana, a Study that will focus on the advancement of a direct air capture and utilization system and is anticipated to aid in developing sustainable approaches to carbon reduction.

United States Department of Energy's National Energy Technology Laboratory (DOE-NETL) has selected the University of Illinois Urbana-Champaign's Prairie Research Institute (PRI) for an award of $3,459,554 for research and development to support a front-end engineering design (FEED) study on carbon dioxide (CO_2) removal technologies. The study will focus on the advancement of a direct air capture and utilization system (DACUS), which can remove 5,000 metric tons per year of CO_2 from ambient air and then permanently mineralize it in concrete products.

The study will launch at U. S. Steel's Gary Works in Gary, Indiana, using a DAC technology developed by CarbonCapture Inc. The technology will use the plant's waste heat, energy, and location, so energy and transportation costs can be minimized. Once CO_2 emissions are captured from the atmosphere, the liquified gas will be transported to Ozinga ready mix concrete plants utilizing CarbonCure's CO_2 removal and utilization technologies, which inject the CO_2 directly into the concrete as it is being mixed. When injected, the CO_2 immediately mineralizes and is locked away in the concrete, never to return to the atmosphere. Permanent CO_2 storage is a crucial component of carbon removal. The permanent storage of 'centuries or more' that carbon mineralization in concrete provides is a critical component of durable carbon removal,"

Source : AIST Steel News Rewind, 22 June 2022

GravitHy Project for Green Iron

EIT InnoEnergy, the innovation engine for sustainable energy supported by the European Institute of Innovation & Technology [a body of the European Union (EU)], Engie New Ventures, Plug, FORVIA, GROUPE IDEC (through GROUPE IDEC INVEST INNOVATION) and Primetals Technologies, have launched **GravitHy** – with plans to build, own and operate first green iron plant in France, mobilising 2,2B€ worth of initial investment. The sustainable iron company will support the growing demand for zero carbon steel, whilst contributing to Europe's ambitions to decarbonise hard-to-abate industries. The **GravitHy** project will build its first plant in the area of Fos sur Mer, Southern France, with construction commencing in 2024. The company aims for the plant to be fully operational by 2027, subject to the required regulatory approvals. **GravitHy** has an ambition to produce an annual throughput of 2 million tons of Direct Reduced Iron (DRI).

The steel sector is responsible for 8% of the global energy demand and 7% of the energy sector CO_2 emissions (including process emissions) annually – making it one of the biggest carbon emitting industries. **GravitHy** supports the emissions reduction of this industry by generating and using green and low-carbon hydrogen to produce DRI. The DRI will be used either on-site as a feedstock for green steel or traded globally under the form of Hot-Briquetted Iron (HBI). This directly contributes to the decarbonisation of the hard-to-abate value chain of steelmaking and supports the EU's ambition of carbon neutrality by 2050.

GravitHy is expected to be a vital component in the French government's proposed steel roadmap and its ambitions to cut CO_2 emissions by 40 percent by 2030. It's aimed to make a step-change in technology, to replace old blast furnaces with DRIs produced from green and low-carbon hydrogen and combined with electric arc furnaces. **GravitHy** is considered as an emblematic initiative that responds to challenges of decarbonisation of the steel sector. This large-scale industrial project is also envisaged to contribute to structuring the decarbonised hydrogen production sector.

EIT InnoEnergy, the world's largest investor in sustainable energy innovations, will provide its business acceleration services through its European Green Hydrogen Acceleration Center (EGHAC), supported by Breakthrough Energy. EGHAC, was set up to serve as a key enabler of industrial value chains and clean tech innovation, with the aim of developing an annual €100B green hydrogen economy by 2025. Engie offers deep knowledge of hydrogen, renewables and electricity markets. Plug offers experience on integrated hydrogen projects and is a leading manufacturer of electrolysers. The GROUPE IDEC, a major player in all segments of the real estate market (development, investment, design-build, energy) will provide services for the industrial site. Primetals Technologies provides cutting edge technology and expertise to enable green and low carbon steel production, whilst FORVIA represents the off-take side of the value chain.

Europe has a strategic interest in developing a thriving hydrogen economy. The European Commission is working to establish a regulatory and financial framework conducive to the emergence of European value chains that will ensure European industrial leadership in this field. The **GravitHy** project is an important milestone and will contribute to the European goal of producing 10 million tonnes of clean hydrogen by 2030.

Source : AIST Steel News Rewind, 22 June 2022

JFE Steel Moves Ahead with Testing CO_2-utilization Technologies Aimed at Achieving Carbon Neutrality

JFE Steel Corporation is moving ahead with two R&D projects to develop technologies that will use CO_2 in steelmaking processes that are expected to help the company eventually to become carbon neutral. One project is a partnership with the Research Institute of Innovative Technology for the Earth ("RITE") aimed at optimizing a system that uses CO_2 for methanol synthesis. The other project is a partnership with Ehime University that is researching and developing CO_2-fixing technology based on fast, large-quantity carbonation of steel slag.

As a result of continued progress with both projects, JFE Steel has now approved the construction of test facilities for making use of steelmaking by-products, including steel slag and combustible gasses such as blast furnace gas. Facilities at its JFE Steel West Japan Works (Fukuyama Area) and East Japan Works (Chiba Area) will accelerate R&D initiatives aimed at significantly reducing CO_2 emissions through more effective use of steelmaking by-products.

System for Methanol Synthesis Using CO_2

- Construction at the JFE Steel West Japan Works (Fukuyama Area) will begin this year and the facilities will enter operation in 2023. Demonstration testing is to be completed within 2025.
- R&D will focus on the commercial launch of a large-scale carbon capture and utilization (CCU) process for be incorporated in a to-be-decided steelmaking method, such one using carbon-recycling blast furnaces.

CO_2-fixing through Fast, Large-quantity Carbonation of Steel Slag

- Construction at the JFE Steel East Japan Works (Chiba Area) will begin in next year and the facilities will enter operation in 2024. Demonstration testing is to be completed within 2025.
- R&D will focus on the fixation (assimilation) of CO_2 generated by steelmaking processes, such as those involving carbon-recycling blast furnaces, and also by thermal power plants, to produce CO_2-fixed steel slag for use in road construction.

The facilities for both projects will be built in response to the New Energy and Industrial Technology Development Organization ("NEDO") 's public invitation to companies and organizations to participate in an umbrella project targeting the development of technologies for carbon recycling and next-generation thermal power generation and also for reducing CO_2 emissions and utilizing CO_2. NEDO will conduct interim assessments within this year and then formulate detailed plans for both projects in/after the fiscal year beginning in April 2023.

In May 2021, JFE announced its JFE Group Environmental Vision for 2050, which places a top priority on addressing climate change, based on which the group is now vigorously exploring a number of viable solutions. Going forward, JFE will continue pursuing a multitrack approach to developing ultra-innovative technologies that will contribute to a more sustainable world.

Source: News Release June 20, 2022, JFE Steel Corporation

Boston Metal's Process of Steel Making

Boston Metal is looking to decarbonise the steel-making sector, at the same time helping iron ore producers with their Scope 3 emissions dilemma.

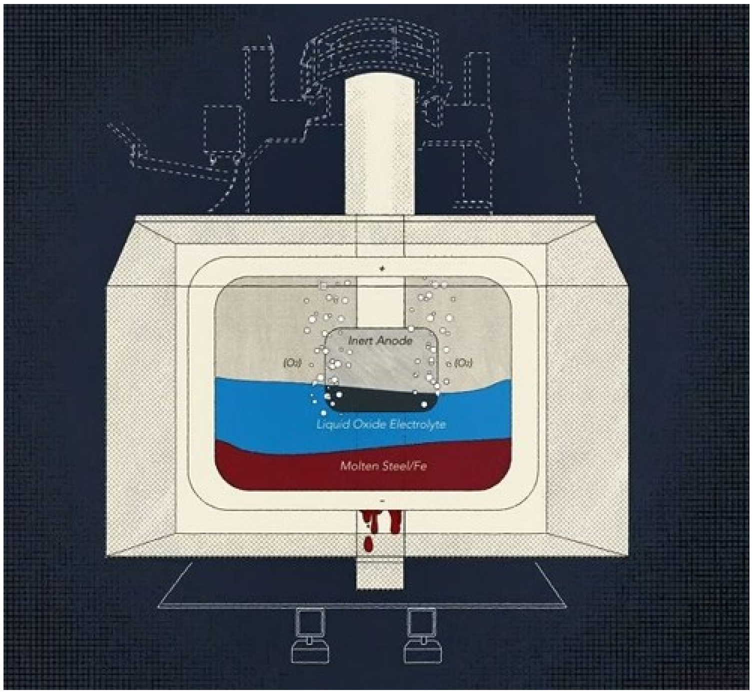
The concept of 'green steel' has emerged over the last few years, with LKAB, SSAB and Vattenfall's HYBRIT project in advanced stage of development – it has already produced fossil-free steel on a trial basis – and its revolutionary way of introducing hydrogen in place of coke as the iron ore reduction method in the steel-making process. SSAB and LKAB are leveraging HYBRIT to completely transform their production processes: SSAB is building new hydrogen-based steel making facilities able to match its current base of 8.8 Mt/y of steel by 2030 and LKAB is moving from iron ore pellet production to direct reduced iron (DRI) in line with this.

The ambitions of such a project are impressive, but can such a green steel-making process be applied to the circa-1,900 Mt of steel currently being produced for the world market? The answer is no, according to Boston Metal.

There are four ways of reducing iron oxides into a metal for steel-making:

- Through the use of carbon
- Through using another metal as a reductant, which is currently not feasible;
- The third one is with hydrogen, which is possible – as HYBRIT has shown – but is limited to premium iron ores;
- Through the solution proposed by Boston Metal.

The Boston Metal solution is – like HYBRIT – a green option, but – unlike HYBRIT – is applicable to all iron ores, regardless of grade.



Boston Metal's process, which it calls Molten Oxide Electrolysis (MOE), works by adding iron ore to an electrolytic cell and passing electricity through said cell. The electricity both breaks the bonds of the iron oxides present, as well as heats up the whole batch within the cell, creating molten iron that sinks to the bottom of the cell ready for collection (tapping). During the bond breaking and heating process, MOE produces oxygen as a by-product, with the resultant oxides forming the electrolyte and remaining in said electrolyte (floating above the liquid iron). Because it is molten, the iron gets separated from the electrolyte and sits in the bottom of the cell. As the molten iron is heavier than the electrolyte, the impurities float to the top and can be tapped separately. So, not only using MOE gets a molten iron product, it also gets a slag by-product that can be used in various applications in the construction industry – all without using coking coal or coke.

In traditional blast furnace-based steel making, iron ore is to be pelletised or sintered and coking coal is to be processed into coke and charged in the blast furnace and air is blown to get pig iron. This pig iron contains around 4% carbon, which needs to be burnt off, in the basic oxygen furnace to get molten iron.

Boston Metal's MOE process gets to this same point using just iron ore and electricity. Sintering/Pelletising and coke making are replaced by a battery of cells that, when assembled in significant numbers, can compete with blast furnaces in terms of molten iron capacity. Significant numbers means, as an example, 300 MOE modules assembled in two lines of 150, which will be able to produce 1 Mt of steel.

If green electricity is available at an iron ore mine, one can bring the cells there, melt the iron and ship a metallic product to steel-makers. This pure iron product can be remelted elsewhere and processed into flat and long steel products for the automotive and construction industries. This represents a higher value-added product for iron ore miners, enabling them to ship a product that is 40% lighter in terms of weight. Finding a 'green' end-user that brings down a miners' Scope 3 emissions while holding a molten iron ore product is a lot easier than finding one when shipping iron fines, concentrate or sinter: hence the reason why iron ore miners' Scope 3 emission goals appear a lot less ambitious than the Scope 1 and 2 targets within their control.

Iron ore miners BHP and Vale have been early backers of Boston Metal.

Producing molten iron through MOE is possible today – but not at a scale the steel-industry would yet consider commercial, but at a pilot scale at least. For the commercial process to be considered green, the MOE would need renewable electricity to do this; and lots of it. MOE will require 4 MWh of electricity per tonne of steel to work at such a scale. This is the equivalent of up to 500 MW for a 1 Mt/y molten iron plant.

If enough scrap is available, the EAF route is the best way to make steel. But the problem is we don't have such scrap availability and, steel coming from iron ore will be needed in next few decades.

The HYBRIT process is expected to require 600 MW of hydrogen electrolyser capacity by 2025 to get LKAB to the 1.3 Mt/y sponge iron (DRI) mark.

Yet, scrap steel is not the only thing in short supply currently. Green electricity is far from abundant, with only the likes of Quebec (hydro power capacity) and some Nordic countries having a plentiful supply.

All the leading steel-making companies have made pledges to be carbon neutral by the 2050s. This means they need to phase out carbon reduction by the mid- to late-2030s. By this point in time, MOE will be ready to offer our solution on a commercial scale, allowing them to take advantage of the abundance of iron ores – low and high grade – around the world.

Source: International Mining News Letter, 22nd July 2022

Production of Non-ferrous Metals in 2021-22 in India

million tonnes

Company	Existing capacity	Production 2021-22	Production 2020-21
Aluminium			
NALCO	4.6	4.60	4.18
BALCO	5.7	5.80	5.68
HINDALCO	13.46	12.94	12.28
Vedanta Ltd.	17.50	16.78	13.72
Total	**41.26**	**40.12**	**35.86**
Copper			
HCL	0.69	0.62	Nil
HINDALCO	5.51	3.95	2.89
SSL	2.38	1.37	1.118
Total	**8.58**	**5.94**	**4.908**
Zinc			
HZL	8.43	7.76	7.15
Lead			
HZL	0.19	1.91	2.14
Silver			
HZL	966000	647015	

Critical Minerals Used in Green Technologies

Mineral	Clean Technology Uses	India's Geological Potential	Top Three Global Extractors
Chromium	Stainless steel alloys (wind turbines)	Yes	South Africa, Turkey, Kazakhstan
Cobalt	Steel alloys, batteries, pigment	Yes	DR Congo, China, Canada
Graphite	Electrical conductors	Yes	China, India, Brazil
Indium	Photovoltaic cells, display technology	None	China, South Korea, Japan
Lithium	Batteries	None	Australia, China, Chile
Manganese	Steel and aluminium alloys	Yes	South Africa, China, Australia
Molybdenum	Steel alloys	Yes	China, Chile, United States
Nickel	Stainless steel alloys	Yes	Indonesia, Philippines, Russia
Rare earth elements	Batteries, electronics, magnets	Some	China, United States, Myanmar
Silicon	Electronics, infrastructure	Yes	China, Russia, Norway