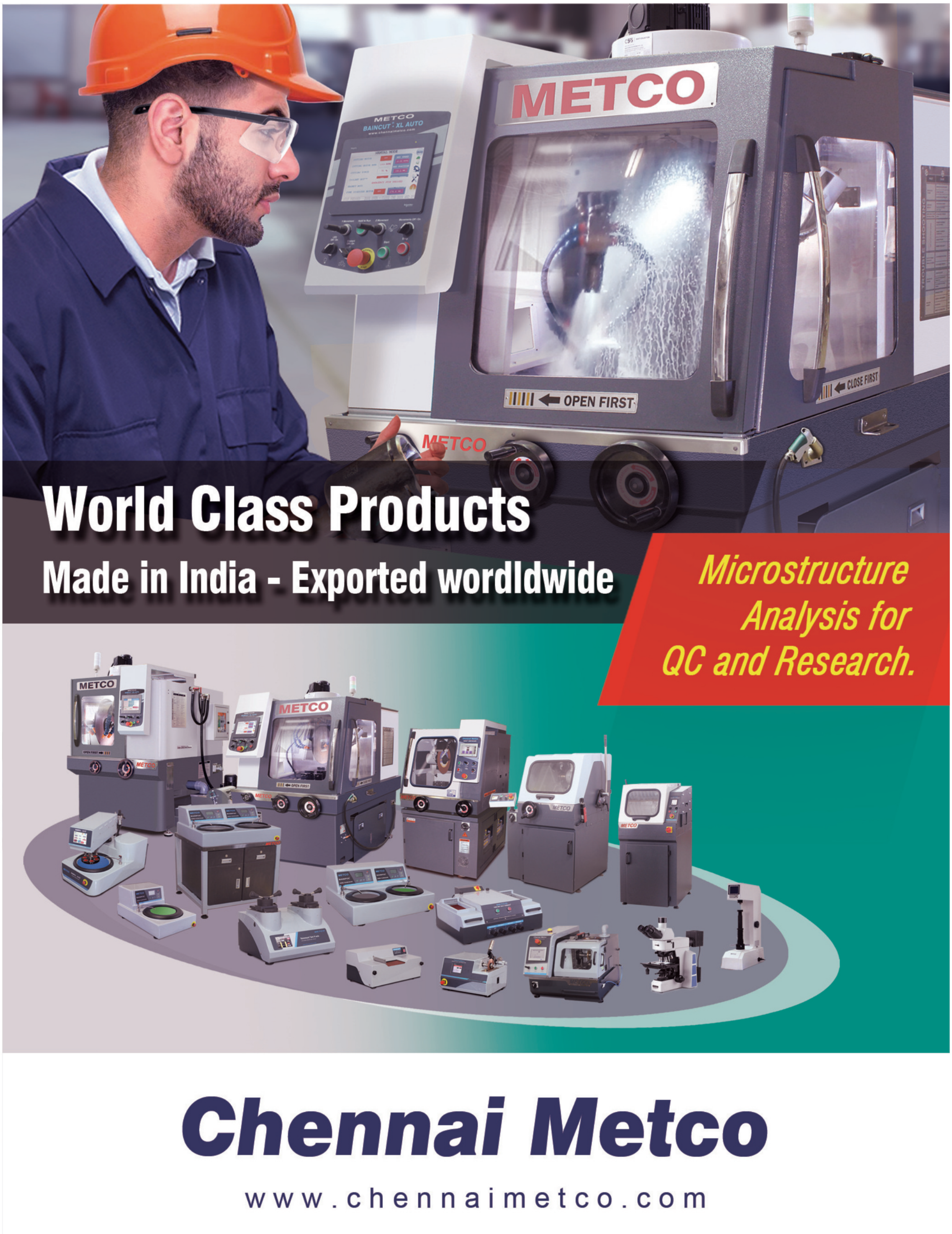
ISSN 0972-0480 • Vol. 27 No. 5 • May 2024

IIM METAL NEWS

A Monthly Publication of The Indian Institute of Metals


METCO
OPEN FIRST
CLOSE FIRST
World Class Products
Made in India - Exported wordldwide
Microstructure Analysis for QC and Research.
Chennai Metco
www.chennaimetco.com

IIM METAL NEWS

Vol. 27 No. 5 May 2024

Printed and Published by
Brig Arun Ganguli (Retd) Secretary General, on behalf of "The Indian Institute of Metals", and
printed at Print Max, 44, Biplabi Pulindas Street, Kolkata-700009
and
published at 'Metal House', Plot 13/4, Block AQ, Sector V, Salt Lake, Kolkata-700091, West Bengal, India

E-mail: secretarygeneral@iim-india.net
publications@iim-india.net
Phone: 033-2367 7089 / 2367 5004
Website: www.iim-india.net
Facebook - https://www.facebook.com TheIndianInstituteofMetals/
Instagram - https://www.instagram.com/indianinstituteofmetals/
LinkedIn - https://www.linkedin.com/company/the-indian-institute-of-metals/
Twitter - https://twitter.com/iimetals_india

The EC Members of IIM Bangalore Chapter who attended the AGM held on 21st March 2024.

THE INDIAN INSTITUTE OF METALS

PATRONS

Mr R M Dastur — Dr Baba Kalyani

ADVISORY COMMITTEE OF FORMER PRESIDENTS

Mr H M Nerurkar	Mr S S Mohanty	Mr Anand Sen
Prof K Chattopadhyay	Prof Indranil Manna	Dr U Kamachi Mudali
Dr R N Patra	Dr Biswajit Basu	Prof Amol A Gokhale

Mr Satish Pai, Convenor

COUNCIL FOR THE YEAR 2023-24

PRESIDENT
Mr Satish Pai

VICE PRESIDENT & CHAIRMAN
Ferrous Division
Mr Sajjan Jindal

VICE PRESIDENT & CHAIRMAN
Metal Science Division
Prof B S Murty

VICE PRESIDENT & CHAIRMAN
Non- Ferrous Division
Dr Komal Kapoor

IMMEDIATE FORMER PRESIDENT
Dr Samir V Kamat

SECRETARY GENERAL
Brig Arun Ganguli (Retd)

HON TREASURER
Mr Somnath Guha

CONTROLLER OF EXAMINATIONS
Prof P K Mitra

CHIEF EDITOR, TRANSACTIONS
Dr S V S Narayana Murty

CHIEF EDITOR, IIM METAL NEWS
Prof K Bhanu Sankara Rao

Jt. SECRETARY
(Office of President)
Dr Vilas Tathavadkar

MEMBERS

Dr Anupam Agnihotri
Prof Amit Arora
Mr Arun Kanti Bagchi
Dr G Balachandran
Mr Sudip Kumar Basak
Dr Suddhasatwa Basu
Mr Chaitanya Bhanu
Dr Debashish Bhattacharjee
Mr Moreshwar Borkar
Mr Anirban Dasgupta
Mr Praveen Jain
Dr S K Jha
Dr V Anil Kumar
Dr Ashok Kumar
Mr R Raj Kumar
Dr D Satish Kumar
Mr Debasish Mallick
Dr Anup Kumar Mandal
Mr Atish Mandal
Dr S Manjini
Prof B K Mishra
Mr Bibhu Prasad Mishra
Dr Suman Kumari Mishra
Mr Arun Misra
Dr Ramanuj Narayan
Dr Vinod Nowal
Prof Ravi Kumar NV
Mr Dilip Oommen
Mr Lalit Kumar Pahwa
Mr Dhiren K Panda
Mr Shishir Kumar Patra
Dr Arijit Saha Podder
Mr Bhimasen Pradhan
Mr Amarendu Prakash
Dr Rajesh Raghavan
Mr Barun Roy
Mr Bhaskar Roy
Mr Sanjay Sharma
Mr Arun Kumar Shukla
Mr Deependra Singh
Mr Lokendra Raj Singh
Dr Dheepa Srinivasan
Dr Avanish Kumar Srivastava
Mr Sharad Suryawanshi
Prof Satyam Suwas
Mr B K Tiwari
Mr Hemanta Kumar Tripathy
Dr M Vasudevan
Dr B Venkatraman

FORMER PRESIDENTS

1946-48	Late J J Ghandy	1977-78	Late V A Altekar	1992-93	Late A C Wadhawan	2007-08	Late Srikumar Banerjee
1948-50	Late P Ginwala	1978-79	Late T R Anantharaman	1993-94	Late R Krishnan	2008-09	Mr L Pugazhenthy
1950-52	Late Phiroz Kutar	1979-80	Late P L Agrawal	1994-95	Dr S K Gupta	2009-10	Dr Sanak Mishra
1952-54	Late G C Mitter	1980-81	Late EG Ramachandran	1995-96	Mr R N Parbat	2010-11	Dr D Banerjee
1954-56	Late M S Thacker	1981-82	Late C V Sundaram	1996-97	Late P Rodriguez	2011-12	Mr M Narayana Rao
1956-58	Late K S Krishnan	1982-83	Late Samarpungavan	1997-98	Late S Das Gupta	2012-13	Mr H M Nerurkar
1958-60	Late S K Nanavati	1983-84	Late J Marwaha	1998-99	Dr C G K Nair	2013-14	Prof K Chattopadhyay
1960-62	Late G K Ogale	1984-85	Late A K Seal	1999-00	Prof S Ranganathan	2014-15	Dr R N Patra
1962-65	Late Dara P Antia	1985-86	Late J J Irani	2000-01	Mr V Gujral	2015-16	Mr S S Mohanty
1965-67	Late B R Nijhawan	1986-87	Late Y M Mehta	2001-02	Late P Parvathisem	2016-17	Prof Indranil Manna
1967-70	Late M N Dastur	1987-88	Late V S Arunachalam	2002-03	Late P Ramachandra Rao	2017-18	Dr Biswajit Basu
1970-72	Late Brahm Prakash	1988-89	Late S R Jain	2003-04	Late S K Bhattacharyya	2018-19	Mr Anand Sen
1972-74	Late P Anant	1989-90	Late L R Vaidyanath	2004-05	Dr T K Mukherjee	2019-20	Dr U Kamachi Mudali
1974-76	Late FAA Jasdanwalla	1990-91	Dr P Rama Rao	2005-06	Late Baldev Raj	2020-21	Prof Amol A Gokhale
1976-77	Late S Visvanathan	1991-92	Dr T Mukherjee	2006-07	Mr B Muthuraman	2021-22	Mr T V Narendran
						2022-23	Dr Samir V Kamat

FORMER SECRETARIES / SECRETARY GENERALS*

1946-57	Late Dara P Antia	1977-86	Late L R Vaidyanath	1997-06	Mr J C Marwah	2013-15	*Mr Bhaskar Roy
1958-67	Mr R D Lalkaka	1986-97	Late S S Das Gupta	2006-13	*Mr J C Marwah	2015-18	*Mr Sadhan Kumar Roy
1968-76	Dr M N Parthasarathi					2018-23	*Mr Kushal Saha

Editorial Board of IIM Metal News

Technical Article

Tensile Test: Peculiarities and Significance

V Yu Filin[1]

Abstract

Static tensile test of structural metals allows to determine a number of strength and plasticity parameters. However, an attempt to assess the values being performances of the metal itself irrespective of test type appears to be very complicated. That is why standard specimens shall be applied. The significance of tensile tests is not restricted by an applicability check of metals. It gives an information about the true stress-strain curve needed for finite-element analysis.

Keyword : Static Tensile Test, Scale True Stress Strain Curve, Size Factor K.

1. Background

Tensile test for strength assessment is known for ages. It is easy to fix a specimen with one end and attach a weight to the other end; add the weight until fracture. Even in XV century Leonardo da Vinci evaluated the strength of wires [1].

Presses are used in industry for several hundred years. The simplest reverser (Fig. 1) allows tensile loading by a press, however the applied load shall be measured to get the information about tensile properties of the test piece. Therefore, special test facilities were invented and load and displacement were measured with weights and levers. One tensile test facility was invented by Eugene-Emil Ville, a professor in mechanics from France (1868). In 1880, Tinius Olsen, an American engineer of Norwegian origin, applied for a patent for invention of an improved test facility. In Russia, a talented engineer Andrey Gagarin was the first director of Saint-Petersburg Polytechnical Institute. In 1896 his mechanical test facility allowing for plotting the test record at compression, tension, bending and torsion (Fig. 2) got a **gold medal of All-Russian Fair** in the city of Nizhny Novgorod.

Standard tensile specimens have a test length of constant cross-section (parallel section, parallel length) of a cylindrical or flat (rectangular) shape. Usually, specimens have enlarged grip parts suitable for clamping by a test machine. Grip parts of cylindrical specimens may be of threaded type, for example, when it is needed to accommodate an extensometer within a short specimen length, or when the Young's modules of the test piece and machine grips are significantly different that may result in slipping out the specimen from the grips.

Within the test length of a specimen the original gauge length l_0 is selected (marked), for which the elongation at fracture is evaluated. The size factor K of a specimen is defined as follows: -

$$K = \frac{l_0}{\sqrt{F_0}}\sqrt{\frac{\pi}{4}} , \qquad (1)$$

where, F_0 is an original cross-sectional area (for a rectangular-shaped test piece $F_0 = t_0 \times b_0$, t_0 is an original thickness, b_0 is an original width; for a cylindrical specimen $F_0 = \pi d_0^2/4$, d_0 is an original test diameter). Equation (1) for a cylindrical specimen may be written as $K = l_0/d_0$.

[1] **National Research Center Kurchatov Institute - Central Research Institute of Structural Materials Prometey, Saint-Petersburg 191015 Russia**

Fig. 1 : Reverser

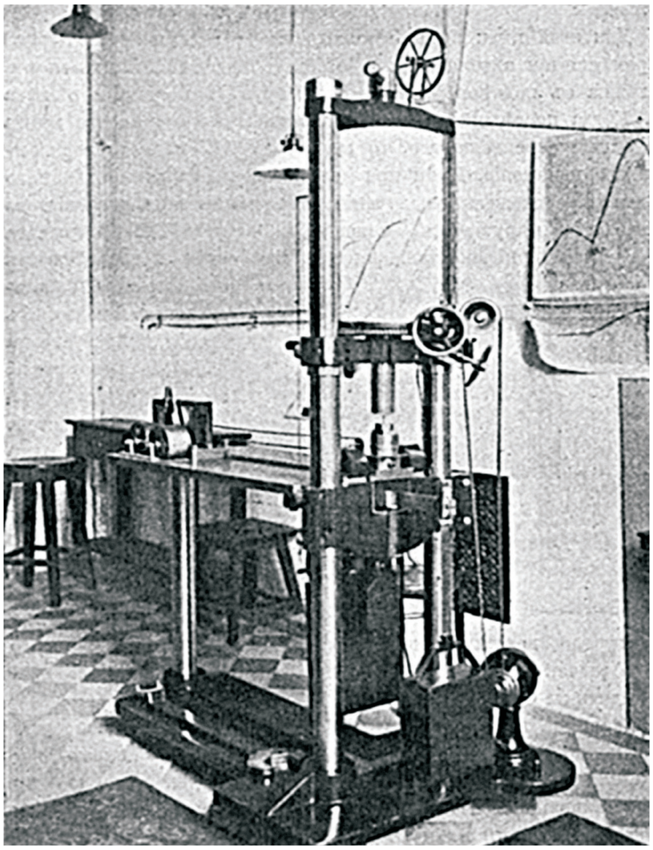


Fig. 2 : Gagarin's Test Facility

2. Evaluation of Test Parameters

Static (quasi-static) loading of a material is a range of strain rates slow enough to avoid dynamic effects but high enough not to result in creep. Such a definition for most structural materials corresponds to a relatively wide range of deformation rates.

For steel specimens, the usual loading rates within the initial elastic part of test record from 3 to 15 MPa/sec, that corresponds to the strain rates from 1.5×10^{-5} to $7.5\times10^{-5}sec^{-1}$. For a displacement-controlled test, setting the piston/crosshead speed of the test facility equal to 0.2 mm per minute corresponds to 3 MPa/sec stress rate for specimens with 220 mm test length and 15 MPa/sec for ones having 44 mm test length. This speed appears to be suitable for the most usable specimen sizes. No significant difference in the measured performances of steel specimens obtained within the above interval of loading rates have been found.

The main direct result of the test is an original load-displacement record. A lot of parameters may be found from this record, their designations are listed below as in the standards ISO 6892-1 and ASTM E8M. Parameters, practically valuable for structural steels are as follows :-

- Physical yield stress YS (Re) corresponding to the Lüders plateau when the test record has a section where the displacement exceeds without load increase,

- Upper yield stress UYS (ReH) corresponding to the first local maximum of the record (when the test record shows discontinuous yielding),

- Conditional yield strength YS when the record does not have the above features, elastic straining smoothly transits to plastic one that does not allow to select a specific point. In this case a yield point is taken on some condition: preset full strain value (Rt) or plastic strain value (Rp). Usually, YS corresponding to 0.2 % plastic elongation of the test length of specimen is considered in most of the laboratory practices (Rp0.2). As soon as the elongation of the test length of specimen at this loading stage is uniform, when an extensometer is attached, the displacement measured by it divided by the initial extensometer length can be used instead.

For pipe steels, the conditional YS (Rt) is normally applicable because these materials are subjected to high deformation during pipe manufacture and are susceptible towards Bauschinger effect. In order to verify the same, the ratio $Rt_{0.08}/Rt_{0.5}$ may be additionally checked. All Rt evaluations are made with an attached extensometer.

During loading after YS, uniform plastic straining of the test length commences accompanied by strain hardening. When the latter one cannot compensate the stress formed in the narrowing cross-section, straining concentrates and necking starts. Deformation in the neck continues to fracture, the applied load decreases. That is why the test facility shall be displacement controlled (close loop). In case it is load controlled, any necking results in a fast rupture of a specimen. The control signal may be taken from a piston/crosshead position or from an extensometer measuring the elongation directly within the extensometer length. When an extensometer is not used, the measured displacement is higher because it includes all gaps and elongation of all the parts of the loading train.

The maximum load from the test record P_m is used to find the ultimate tensile stress: UTS (Rm), Rm = P_m/F_0.

In addition to strength parameters, ductility of metal can also be calculated from such tests, namely :-

- relative elongation at fracture δ (A),

$$\delta = \Delta l/l_0,$$

where Δl is an elongation of the specimen gauge length measured after fracture,

- relative uniform elongation Elu (Agt) or its plastic component Ag corresponding to the point of load maximum P_m,

- relative reduction of area in the neck,

$$\Psi = (F_0 - F_f)/F_0,$$

where F_f is the final cross section in the neck measured after fracture.

3. Peculiarities of the Test Procedure

In general, while clamping of a specimen into the grips of the test facility, some load is taken by the sample, it may be negative (compression) or positive (tension). This load shall not be zeroed by software, it is allowed to slightly move the piston/traverse to the position corresponding to zero load.

As the test record is the main original information, it shall be available. Extensometer, if used, may be removed after recording all the events related to yielding. Yielding of the material may first start in the transition locations from the test part to grips out of the extensometer length, in this case records constructed from the extensometer and piston/traverse signals will be different. Difference is also detected when the neck forms out of the extensometer length. This way, the use of an extensometer makes feasible the evaluation of parameters needing the measurement of total strain, but fracture location in relation to the extensometer length shall be known and the record taken from piston/crosshead position should be available for comparison.

An absence of bending during tension should be provided. The quality of cylindrical specimens is checked by rolling them along a flat surface. Full-thickness flat specimens made of curvilinear and pipe blanks shall be straightened. As the yield stress changes after straightening, in critical cases both types of specimens are tested for comparison, flat ones after straightening and cylindrical ones without straightening.

When a residual deflection of a specimen is expected, the extensometer for tensile test shall be installed in a specific position in relation to the bend plane, or two extensometers are mounted (Fig. 3). In some cases, bending during tensile tests is avoided by the use of test facilities with one tilting grip.

For the self-check, Young's modulus is found from the initial elastic section of the test record obtained with the use of an extensometer. Exact determination of Young's modulus is, as a rule, impossible, however a deviation about 10% from the expected value may be interpreted as an extensometer malfunction or a mistake in manual input of specimen dimensions, e.g. test length instead of extensometer length.

Particular care should be paid on measuring tools. For example, neck diameter for the evaluation of the reduction of area shall be measured with a caliper equipped with knife edges.

In general, the effect of specimens surface roughness onto the tensile test result is usually neglectable. However, circumferential dents, roller traces, punch marks and so on within the test length may lead to an early strain localization and a corresponding decrease in elongation. A similar effect appears when testing metal with corrosion pits. We had tested a fragment of a ship hull raised from the bottom of Baltic sea (Fig. 4). As a residual thickness of plating was below 2 mm, flat specimens were tested. Early strain localization at pits twice decreased the measured elongation.

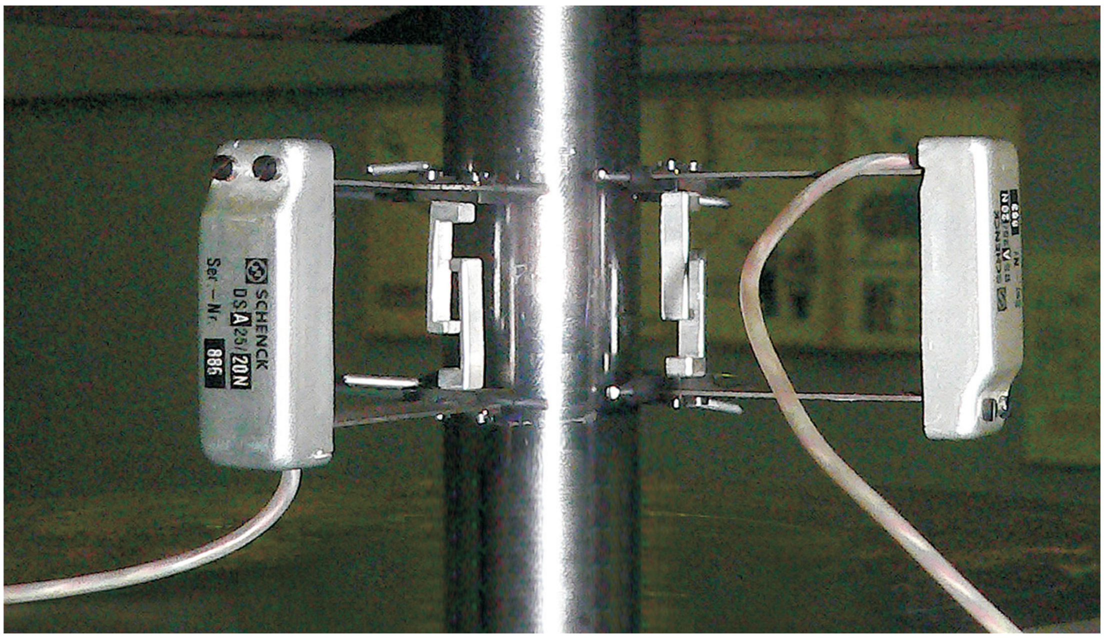


Fig. 3 : Test with Two Extensometers

Fig. 4 : Corroded Fragment of Ship Plating

4. On the Evaluation of the Performances of Material at Tension

In the first half of XX century, it was considered that the yield stress cannot be a parameter of material because the way of its determination depends on the appearance of the test record, presence of the first local maximum and Lüders plateau. However, this particular parameter is used by designers to select a material for their structures. To find YS in absence of a distinct linear portion of the test record, a hysteresis technique is applied: complete unloading and subsequent loading is performed after passing all the events related to yielding.

Ultimate strength is not a performance of the material, it relates to the test method only. Obviously, in conditions of stress state triaxiality, when the first principal stress attains UTS, no fracture sill be observed. An illuminative example is given below. Let us consider a fully elastic material (rubber). Hooke's law is valid:-

$$\sigma = E\varepsilon. \tag{2}$$

When tension takes place along Y axis,

$$\varepsilon = \varepsilon_y$$

$$\sigma_x = \sigma_z = 0,$$

but

$$\varepsilon_x = \varepsilon_z = -\nu.\varepsilon, \tag{3}$$

where ν is a Poisson's ratio.

The applied load is

$$P = \sigma F, \tag{4}$$

where the cross-section area of the specimen F may be calculated via the dimensions along x and z coordinates using a shape factor α (α = 1 for rectangular section),

$$F = \alpha \cdot x \cdot z.$$

Adding subscript "0" for original (initial) values, we get

$$P = E\varepsilon \cdot \alpha \cdot x_0 \exp(\varepsilon_z) \cdot z_0 \exp(\varepsilon_z) = \frac{E \cdot F_0}{\exp(2\nu\varepsilon)} \ . \tag{5}$$

The following condition will correspond to the load maximum P_m (i.e., UTS),

$$dP/d\varepsilon = 0. \tag{6}$$

This way,

$$E \,.\, F_0(\exp(2\nu\varepsilon) - 2\nu\varepsilon(\exp(2\nu\varepsilon) = 0$$

$$1 - 2\nu\varepsilon = 0 \tag{7}$$

For a fully elastic material we have got a very high but definite value of UTS:

$$\mathrm{Rm} = P_m / F_0 = E\varepsilon \cdot \exp(2\nu\varepsilon) = E \cdot \exp(1)/(2\nu)$$
$$= E \cdot e/(2\nu), \tag{8}$$

Therefore, it relates to the method of measurement but not to the mechanical properties.

The value of relative elongation at fracture depends on the specimen size factor. In the year 1928, D.A.Oliver's interview for bachelor's degree was accepted titled "Proposed new criteria of ductility from a new law connecting the percentage elongation with size of test-piece" [2]. For this work, only 14 tensile specimens was tested. The test length of specimens was multiple marked to get several gauge lengths and, consequently, several size factors *K*. Oliver used the formula introduced in 1922 by C.A.Bertella in an attempt to find "more fundamental" performances of material [3]:

$$\delta = \frac{\Delta l}{l_0} = C\left(\frac{l_0}{\sqrt{F_0}}\right)^n, \tag{9}$$

where *C* and *n* are constants.

Since that time, the equation used to recalculate the elongation values is known as Oliver's formula:

$$\delta_K = 2\delta_5\left(\frac{\sqrt{F_0}}{l_0}\right)^{0.4} = 2\delta_5\left(\frac{1}{K}\sqrt{\frac{\pi}{4}}\right)^{0.4} \tag{10}$$

where δ_K is a relative elongation at fracture of a specimen with *K* size factor,

δ_5 is a relative elongation at fracture of a specimen with *K* = 5,

0.4 is an exponent for carbon and low-alloyed steels.

It is considered that formula (10) allows tensile testing of specimens with different *K*, including specimens of different cross-section but the same test length. The obtained elongation values may be recalculated to compare with a requirement. The use of equal test length is suitable in conditions of plant laboratories because it is enough to have a single set of milling cutters, there is no need to rearrange the test fixture, it is easier to arrange autofeed of specimens. The full thickness of metal may be kept. Oliver's formula is standardized (e.g. in ISO 2566-1). However, no physical explanation of relevant constants has been given till date.

A relative uniform elongation may be considered a real performance of material. More accurate, it shall be a uniform strain ε_u:

$$\varepsilon_u = \ln(1 + Agt),$$

that is by definition is equal to the strain hardening exponent *n* of the true stress-strain curve representation as a power function by John Herbert Hollomon young:

$$\sigma = R_p(\varepsilon/\varepsilon_t)^n, \quad (11)$$

where ε_t is a total strain corresponding the yield point. The issue in ε_u calculation from the test record is a usual very smooth behaviour of materials near the P_m point, so it may be inaccurately found.

Relative reduction of area at fracture is classically related to the critical strain attained in the neck ε_{icr},

$$\varepsilon_{icr} = \ln(1/(1-\Psi)), \quad (12)$$

FEM simulation allows to clarify that equation (12) allows to only find some "average" value of critical strain in the neck. Typical value of relative reduction of area of structural and shipbuilding low-alloyed steels is $\Psi = 0.70$ that corresponds to $\varepsilon_{icr} = 1.20$. However, the FEM calculated maximum plastic strain intensity is attained at the axis of the neck, it makes about 1.60. On the other hand, the experiments of A.V.Larionov [4], FEM simulation and X-ray diffraction analysis of fully ductile fracture surfaces of specimens with containing an initial crack testify to the plastic strain level about 0.60. This way, the critical plastic strain and, consequently, the relative reduction of area is not a performance of the material.

As a result it may be noted that strength and plasticity parameters found during tensile testing are directly suitable for material selection by a designer in the only case when a standard test method and specimens of the same *K* factor have been used. *K* = 5 is usually applied. A scale effect at tension should be also considered. Generally, this effect should not be observed for homogeneous material, Fig. 5 gives FEM results for cylindrical tensile specimens of different diameter but the same *K* (high-strength steel, YS = 670 MPa). For both specimens, $\varepsilon_{icr} = 1.60$; $\Psi = 72$ %.

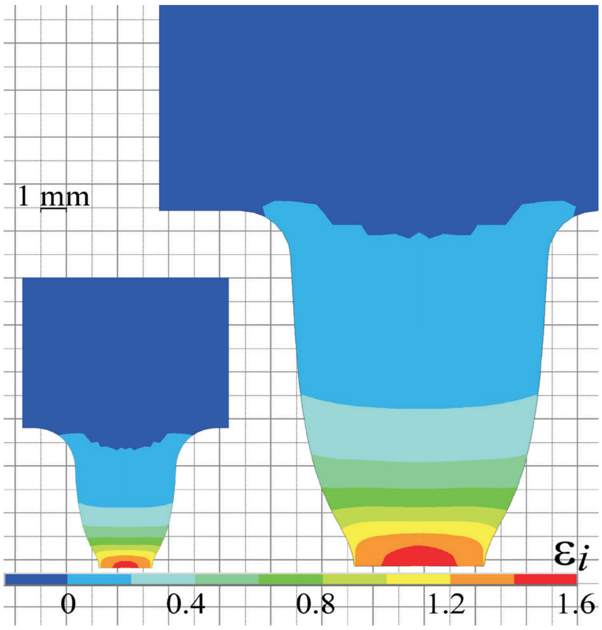


Fig. 5 : FEM Results of Tensile Test Simulation with Cylindrical Specimens of Different Size

However, specimens of the maximum feasible size are recommended to be tested due to the following reasons:

i) if a material has heterogeneous through-thickness properties, a specimen of larger size would be more representative;

ii) elastic energy collected in the same test facility when testing a larger specimen is also higher, so even under displacement control such a specimen may fracture earlier than the small one, that gives an error to the safe side.

The significance of experimental tensile curve is much higher. It can be the basis to calculate an accurate "true" stress-strain curve instead of (11), Ramberg-Osgood or any other relationships further used as a description of material behaviour in FEM calculations.

In our institute an original procedure of true stress-strain curve evaluation has been developed for shipbuilding steels. It includes FEM calculations for verification: tensile test is simulated with a specimen of original dimensions used in experiment, the simulated test record is compared with the real one [5]. After an attainment of satisfactory matching, the digital model of material is kept in the library for subsequent FEM solution of deformation problems. At the same time, a ductile fracture criterion of the material being the modified Kockroft-Latham-Oh one is evaluated for the point of the simulated record coinciding with the point of fracture of the real specimen.

5. Conclusions

(i) Static tensile test is a traditional way of evaluating strength and ductility parameters of structural materials, including plant acceptance tests.

(ii) At the apparent simplicity of the test, getting of correct values needs an accuracy in measurements and exact knowledge by an operator of the relevant terminology (which lengths shall be set in the software, what is the difference between elongation and strain).

(iii) The obtained strength and ductility parameters can be in general related to this particular test type only. They are used for quality assessment of materials and their selection by a designer.

(iv) At the same time, the experimental stress-strain curve allows to construct a "true" curve and apply the latter one in FEM simulation of structures. In parallel, a ductile fracture criterion of tested material can be found, that is acceptable for FEM simulation in cases of predominating first principal stress that is typical as for smooth tensile specimens as for cracked bodies.

6. Acknowledgements

The author would like to acknowledge Dr. A.V.Ilyin, Deputy General Director Prometey and the outstanding scientific adviser.

References

1. J.R.Lund, J.P.Byrne. Leonardo da Vinci's Tensile Strength Tests: Implications for the Discovery of Engineering Mechanics. Civil Engineering and Environmental Systems. Vol. 18, 2001 - Issue 3. pp. 243-250. https://doi.org/10.1080.02630250108

2. Oliver, D. A., Proceedings of the Institution of Mechanical Engineers, 1928, p.827.

3. Bertella, C. A., Giornale del Genio Civile, Vol 60, 1922, p. 343.

4. A.V.Larionov, V.Yu.Filin, A.V.Ilyin. Ocenka svyazi soprotivlenija materiala vjazkomu razrusheniju s pogloschennoj energiej pri ispytanijakh padayuschim gruzom [On the correlation of shear fracture resistance of metal with the absorbed energy at drop weight tear test] Fiziko-mechanicheskije ispytanija, prochnost', nadezhnost' sovremennykh konstrukcionnykh i funkcionlknykh materialov: Maretialy XIV Vserossijskoj konferencii po ispytanijam i issledovanijam svoistv materialov "TestMat" [Physical-mechanical tests, strength, reliability of modern structural and functional materials: Proceedeings of XIV All-Russian conference on testing and investigation of material properties] Moscow, 25 march 2022. NRC Kurchatov institute - VIAM Publ., 2022. - 540p., p. 506-520 (in Russian).

5. E.D.Nazarova, M.M.Peglivanova, V.Yu.Filin, A.V.Larionov. Poluchenie istinnoi diagrammy nagruzhenija na osnove ispitanij na rastjazhenie s ispolzovanijem chislennykh metodov [Getting true loading curve on the basis of tensile tests with an application of numerical methods] Nedelja nauki PhysMech: sbornik materialov Vserossijskoj nauchnoj konferencii [Week of science PhysMech, proceedings of the All-Russian scientific conference] Saint-Petersburg, April 03-07, 2023. POLYTECH-PRESS, 2023. - 400p., p. 29-32 (in Russian).

****

INSTRON®

Instron offers an extensive range of fully integrated static, dynamic and fatigue testing systems from 1000N up to 5000kN. Incorporating electromechanical servo-hydraulic, servo-electric, and linear motor technologies, these test instruments cover a broad range of fatigue, dynamic, and static testing applications. These applications include static testing, high-cycle fatigue, low-cycle fatigue, thermo-mechanical fatigue, fracture mechanics, crack propagation and growth studies, fracture toughness, bi-axial, axial-torsional, multi-axial, high strain rate, quasi-static, creep, stress-relaxation, earthquake simulation, structural test applications and other types of dynamic and static tests.

Product Portfolio

Electromechanical Test Systems for Static Test Applications
Servo-Hydraulic Test Systems for Dynamic Test Applications
Shaketables for Seismic Studies
Configurable Actuators, Powerpack and Controls for Structural Applications
Damper Test Systems
Upgrades/Retrofits

Markets We Serve

Academia, Automotive
Aerospace, Biomedical
Building and Construction
Metals, Plastics, Composites
Electronics, Textiles, Rubber...
Energy and Power...


DASTUR
Green Steel
Flexible Design & Engineering
Environment & Sustainability
Techno-economic Assessments
Logistics & Distribution
Operations & Process Improvements
Advanced Analytics, Process Modeling, Simulation
Business
Technology
Engineering
Operations
India | Germany | USA | UAE | Japan
www.dastur.com
www.dasturenergy.com

News Updates

Domestic

JSL Charts Rs 5,400 Crore Strategic Investment Plan

Jindal Stainless Limited (JSL) announced a Rs 5,400 crore investment plan to expanding its capacity by 1.2 Mtpa to 4.2 Mtpa. The Company will be taking over Chinese stake in a Gujarat based steel mill, expanding its own capacity in Jajpur (Odisha), and setting up capacity in Indonesia through a joint venture (JV).

The Company plans to fund the capacity addition a mix of internal accruals and a small component of debt, Abhyuday Jindal, JSL's Managing Director told reporters.

"The Indonesian JV will get us the best of speed and raw material security, and the augmentation of the Jajpur lines will offer enhanced value for domestic and export customers. The cold rolling mill at Chromeni will expand our outreach, both in India as well as abroad, and strengthen our presence in the value-added segment in the long term," he said.

The Company currently had a debt of Rs 4,800 crore that would go up by about Rs 300-500 crore by end of current fiscal in view of the expansion plan.

JSL also said it will acquire a 54% equity stake of Tsingshan Holdings in Chromeni Steels Private Limited (CSPL), which owns a 0.6 Mtpa cold rolling mill in Mundra, Gujarat.

The Economic Times (1.5.2024)

Jindal Stainless Eyes 20% Volume Growth in FY25, to Spend over Rs 5,000 Crore on Capex

Jindal Stainless is eyeing a 20% growth in its sales volume to 2.5 million tonne in the current financial year and will be spending more than Rs 5,000 crore on capital expenditure this year, the Company's senior management said.

The country's largest producer of stainless steel sold 2.17 million tonne of stainless steel in 2023-24 (Apr-Mar), a growth of 23%, surpassing the Company's guidance of 20% for the year.

Earlier this month, the Company had announced capacity expansion at its downstream unit, the buyout of majority stake in a steel Company, and a joint venture for a steel melting shop in Indonesia, for which it will be spending Rs 5,400 crore over a period of three years.

In FY25, the Company plans to spend Rs 4,700 crore on capex, of which Rs 800 crore is a spillover from the previous year. The Company will also spend an additional Rs 500 crore on sustenance and maintenance capex, group chief financial officer Anurag Mantri said on a call post the Company's earnings.

Most of the capex this year will be spent on funding the buyout, and the Company will meet most of its requirements through internal accruals, he said. Jindal Stainless spent Rs 3,000 crore on capex in FY24.

The Company has also guided for its operating profit in the range of Rs 18,000 – 20,000 per tonne this year, as against Rs 18,558 rupees last year. Exports are seen in the range of 10-15% for the year, as against 13% earlier.

"We are seeing a recovery in certain segments of Europe, while recovery in the US is taking longer," managing director Abhyuday Jindal said. While these two regions are the largest export markets for the Company, they are also exporting to South America, Mexico and the Middle East, he said.

Jindal Stainless reported its earnings for the March quarter, and its consolidated net profit slumped 30% on year to Rs 501 crore. Consolidated net revenue fell 3% on year to Rs 9,454 crore, while the operating profit fell 10% on year to Rs 1,035 crore.

The Economic Times (15.5.2024)

Keeping Close Watch on Steel Imports: SAIL Chairman Amarendu Prakash

SAIL, the country's largest steel player, is keeping a close watch on the imports of the commodity, the Company's Chairman Amarendu Prakash said. The official made the remarks while replying to a question on the impact of the US imposing heavy tariffs on various Chinese items such as electric vehicles, batteries, steel, solar cells, and aluminium.

"We are keenly watching the imports," Praksh told PTI on the sidelines of a national workshop 'Forging Sustainability in Steel Sector' organised by the Ministry of Steel in the national capital.

Recently, Tata Steel CEO T V Narendran had also said there is a need to be watchful about the imports of steel.

As per official figures, India reported a 38 per cent surge in steel imports to 8.319 million tonnes, becoming a net importer of the commodity during the 2023-24 financial year. Steelmakers have been raising concerns on increasing imports from certain countries, mainly China and seeking the government's intervention on the issue.

The Economic Times (17.5.2024)

Government Working on Policy for Low Grade Iron Ore Beneficiation: Steel Secy

The government is working on a policy for low grade Iron ore beneficiation, a move that will increase the usage of Iron ore with less Iron content in steel production. Speaking to PTI, Steel Secretary Nagendra Nath Sinha said the Ministry of Steel along with the Ministry of Mines and the Ministry of Environment, Forest and Climate Change of India is working on the policy.

When asked about the timeline, he said the policy on the beneficiation of low grade Iron ore is expected to be completed within three months' time.

"There may be some concessions on the royalty (on production of fines in the policy)," Sinha said without elaborating further.

While lump ore or high-grade Iron ore contains 65.53 per cent Fe (Iron), fines are inferior grade ore and have 64 per cent and less Fe content.

The use of Iron ore with less Iron content needs beneficiation which adds to the cost of steel production.

Earlier, Union Steel Minister Jyotiraditya Scindia had asked the domestic steel industry to adopt low-Carbon emitting steel-making processes, while cautioning that key raw materials Coking Coal and Iron ore may not be a viable option in the future based on environmental, social, and governance (ESG) parameters.

The Economics Times (17.5.2024)

Jsw Steel to Spend Over Rs 19,000 Crore to Expand Dolvi Plant

The cost of JSW Steel's third phase of capacity expansion at its plant in Dolvi will be among the lowest for brownfield expansions for the Company, a top official told ET.

JSW Steel will spend a little over ₹19,000 crore on this capacity addition, which will help it cater to the demand for value-added special steel products, Jayant Acharya, Chief Executive Officer of JSW Steel, said. "It will be very cost effective since some of the infrastructure facilities are already there (and) some of the equipment are already there as part of phase two," he said.

This investment will take the firm's total capital expenditure to more than ₹64,000 crore in three years.

The country's largest producer of steel announced that it will be adding another 5 million tonnes of capacity at its plant in Dolvi, Maharashtra, taking it to a total 15 million tonne per annum by September 2027. Pan-India, the Company aims to have a total production capacity of 42 million tonnes by then.

The National Steel Policy 2017 envisages India's steel production capacity at 300 million tonne by 2030-31.

The Economic Times (20.5.2024)

Tata Steel Signs Grid Agreement to Make its Uk Project Green

Tata Steel has signed an agreement with National Grid plc's Electricity System Operator to build the power infrastructure required to switch its Port Talbot site to a green steel project.

The deal will see the British grid operator build the new electrical framework capable of powering the Indian Company's 3.2 million-ton electric arc furnace by the end of 2027.

"This will help us replace our aging and Carbon-intensive blast furnaces with a state-of-the-art electric arc furnace capable of producing our customers' most demanding steel products," said Rajesh Nair, Chief Executive of Tata Steel UK, in a website statement.

The Economic Times (21.5.2024)

India Only Nation among Top 5 to See Growth in Steel Production

India is the only country, among the top five steel producing nations, to have seen a growth in production in April, with the others seeing production drop by as much as 7% during the month.

China, which is the world's largest producer of steel, has seen its production in April fall more than 7% on year to 85.9 million tonne. Its production from January-April this year, at 343.7 million tonne, is 3% lower as compared to 2023, data from the World Steel Association showed.

India, which is the world's second-largest producer of steel, saw production rise by 3.6% to 12.1 million tonne. The country has seen an 8.5% growth in production between Jan-Apr this year, having produced 49.5 million tonne of steel.

Japan, United States and Russia have seen their production of steel decline by 2-6% on year during the month. Excluding India, the four largest steel-producing nations have also seen a drop in their production numbers drop, compared to the last year, between the January-April period.

This data indicates that while the consumption of steel in India remained robust, the global demand for steel is yet to see a recovery.

"High interest rates and inflation have culled demand from steel-consuming sectors in the western world. In 2023, crude steel production growth was flat on-year. It is expected to be rangebound in 2024," Sehul Bhatt, director for research at CRISIL Market Intelligence and Analytics told ET.

The Economic Times (23.5.2024)

Shyam Metalics Expands Rail Infrastructure at its Steel Plant in Odisha

Shyam Metalics and Energy Limited (SMEL) completed expansion of its rail infrastructure at its integrated steel plant in Pandloi, near Rengali in Odisha's Sambalpur district, aligning with the Company's long-term goal of sustainability.

The plant, which also includes a coal washery and power plant, has seen rapid growth in recent years including realising the need for better rail facilities to efficiently manage the increased flow of raw materials and finished products.

Previously, the plant operated with two dedicated railway lines. The recent expansion, completed in 2023, has doubled this number to four lines, SMEL said in a media release.

This includes a lead line from Rengali station, three branch lines, and an engine escape line.

Moreover, the project, initially approved by the Indian Railways in 2015, now features fully operational overhead electrification, the Company said.

The plant's enhanced rail infrastructure now handles over 110 rakes per month. While this is a substantial improvement, according to the Company, the current setup can only manage around 60 per cent of the increased demand for raw materials and finished goods.

To address this, SMEL plans to introduce a wagon tippler by 2028. This equipment will further streamline rail operations, doubling the plant's rail handling capacity and ensuring faster turnaround times for wagons.

The Economic Times (27.5.2024)

****


ADITYA BIRLA
HINDALCO

Chapter Activities

Kalpakkam, Kanpur, Bhubaneswar, Vijayanagar

Kalpakkam Chapter

1) A 2-day course on Artificial Intelligence in Materials Engineering (AIME-2024) was conducted jointly by IIM HRDC (Kalpakkam Chennai), IIM Kalpakkam and IIM Chennai Chapters on April 26-27, 2024 at Hotel Radha Regent, Chennai. The course comprised in-depth lectures on the cutting-edge applications of Artificial Intelligence for materials engineering, delivered by leading domain experts. The course was attended by over 100 delegates from industry, academia, research scholars and UG/PG students. The course began with a primer on the fundamentals needed for development and use of AI methods in various materials domains, including materials discovery, materials design, process discovery, and optimization of industrial processes. Various case studies and advances were presented from areas as diverse as peptide discovery, optimization of industrial decision-making processes, AI-augmented interatomic potential development, enhancement of microstructural data and optimal selection of welding process parameters etc.

Glimpse of AIME-2024

2) The 42nd Annual General Body Meeting of IIM Kalpakkam Chapter was held on 3rd May, 2024, at Indira Gandhi Centre for Atomic Research, (IGCAR), Kalpakkam. The meeting was attended by 46 members in person. The Secretary's Report on Chapter activities and Treasurer's Report on audited statement of accounts were presented and passed in the AGM. Dr M. Vasudevan felicitated the recipients of the Best Paper Awards for Journal publications for both 'Under-35' and 'General' category. The meeting concluded with the announcement of new EC members and Office Bearers. Dr. V. Karthik assumed the charge of Chairman, Dr. S. Ningshen as the Vice-Chairman, Dr. Diptimayee Samantaray as the Secretary, Dr. G. Sainath took the responsibilities of the Joint-Secretary and Shri V. Ganesan continues as the Treasurer of the IIM Kalpakkam Chapter.

The Best Paper Award Winners of 'Under-35' and 'General' category are as under:

'General' Category -

1. **M. Divya -** Weldability study of 304HCu stainless steel using varestraint and "Gleeble" based hot ductility tests, Materials Today Communications, 37 (2023), pg. 106938.

2. **J. Vanaja -** Creep Performance and Microstructural Characterization of Electron-Beam Welded 316LN SS-Grade 91 Steel Dissimilar Joint, Metall. Mater. Trans. A, 54, 3005–3020 (2023).

'Under-35' Category -

1. **S. Hari Babu -** Phase Selection and Microstructure Evolution in Laser Additive Manufactured Ni-Based Hardfacing Alloy Bush, Metallurgical and Materials Transactions A, 55A, 218-231,2024 (published online Nov2023).

2. **A. R. Pavan -** Microstructures and Creep Properties of Type 316LN Stainless Steel Weld Joints, Metallurgical and Materials Transactions A, 4868, Volume 54A, December 2023.

3. **Ankita Pal -** High contrast corrosion mapping of dissimilar metal weld joints using alternating current scanning electrochemical microscopy: A case study with Zr-4–Ti–304L SS weld, Corrosion Science, 221(2023), 111345 (IF: 8.3).

AGM of IIM Kalpakkam Chapter



Kanpur Chapter

1) Materials Camp: The Chapter organised the Materials Camp which was held during 3-6 May, 2024, at IIT Kanpur. A total of 37 Students and 9 Teachers participated from 9 Schools in Kanpur. The Camp aimed to educate young students and teachers about materials science through hands-on experiments and lectures. The IIM Kanpur Chapter co-organised the event, contributing to its success in fostering a deeper understanding of Mat. Sc. among the participants.

2) Annual General Meeting: The Annual General Meeting (AGM) of the IIM Kanpur Chapter took place at 5pm on May 7, 2024 in the Department of Materials Science and Engineering, IIT Kanpur. The meeting saw an impressive turnout from both Executive Committee and Student Members. During this dynamic session, the roadmap and vision for the Chapter's progress for the 2024-2025 period were outlined and discussed in detail.

Participants and the Faculties at the Materials Camp

Annual General Meeting of IIM Kanpur Chapter

Bhubaneswar Chapter

The Annual General Body Meeting (AGBM-2024) of IIM Bhubaneswar Chapter was held on 20th May 2024 at CSIR-IMMT Bhubaneswar. The Chief Guest Shri Sadashiv Samantray, Director (commercial), NALCO delivered the lecture on the topic "Aluminium- The metal of 21st century". The Guest of Honor Prof. K.G. Prasanth, Head, Additive Manufacturing Centre, Tallinn University of Technology delivered a technical talk on "Advances in additive manufacturing". The Guest of Honor,

Dr. Ramanuj Narayan, Director, CSIR-IMMT delivered his talk on how to improve the Chapter-performance.

On this occasion, Dr. Pravat Kumar Sahoo, Prof. B.C. Mohanty, Dr. S.K. Tamotia, Dr. D.S. Rao were felicitated for their significant contribution to the IIM Bhubaneswar Chapter. Dr. R. Bhima Rao, former chief scientist, CSIR-IMMT and Dr. Satya Prakash Mohapatra, DGM, NRTC received IIM Bhubaneswar Chapter Award and Dr. S.K. Tamotia Award, respectively. Dr. Pravas Ranjan Behera and Dr. KJ Sankaran were elected as Secretary and Treasurer of the Chapter. About 90 persons including 78 IIM members of Bhubaneswar Chapter attended the AGBM-2024. After the event, all the members joined for Dinner at CSIR-IMMT's Guest House Lounge.

Welcome of Chief Guest: Shri Sadashiv Samantaray (left), Director (Commercial), NALCO, Guest of Honor: Prof. Dr. K.G. Prashanth (middle), Tallinn University of Technology, Estonia, Guest of Honor: Dr. Ramanuj Narayan (right), Director, CSIR-IMMT Bhubaneswar.

Vijayanagar Chapter

1) IIM-ATM 2024 Brochure and Website Launched : JSW Steel Ltd has unveiled the Brochure and Website for the "IIM-ATM 2024: 78th Annual Technical Meeting (ATM) of The Indian Institute of Metals". The prestigious event is expected to attract a diverse audience from industries, academia, and research institutions related to materials science.

This year, JSW Steel Ltd., along with the IIM Chapters of Vijayanagar, Dolvi, Salem, and Bangalore, is proud to host the event. The mega event is scheduled to take place from November 20-22, 2024, at Gandhi Krishi Vigyan Kendra (GKVK) at the University of Agricultural Sciences, Bengaluru. Over 2,000 delegates, including industry veterans, engineers, metallurgists, and scholars from across the country, along with a few international speakers are expected to participate in the event.

Mr. Satish Pai, President IIM and Managing Director of Hindalco Industries along with Mr. Sajjan Jindal, Vice President IIM and Chairman JSW Group, officially released the IIM-ATM 2024 Brochure at the 364th Council meeting held on May 21, 2024 at the Group Headquarters—JSW Centre—in Mumbai. The meeting was attended by many senior members of IIM. The Brochure provides comprehensive details about the event, including schedules, sessions, and speaker information.

In addition, the new IIM-ATM 2024 Website has been launched with a user-friendly designed interface having an interactive features that enhances the participant experience.

The website – https://iimatm.in/ is now open for registration and abstract submissions.

Unveiling the IIM-ATM 2024 Brochure by Mr. Satish Pai and Mr. Sajjan Jindal

An August Gathering of Eminent Personalities of IIM during the Council Meeting #364

2) IIM Vijayanagar Chapter Lecture Series – 1st Lecture by Mr. Satish Pandey, Principal Scientist, CSIR-Central Road Research Institute: IIM Vijayanagar Chapter conducted their 1st lecture for the year 2024-25 on Thursday, 30th May 2024 at Experience Centre. Lecture was delivered by Mr. Satish Pandey, Principal Scientist, CSIR-Central Road Research Institute, New Delhi on STEEL SLAG ROAD: VALORIZATION OF STEEL SLAG AS PROCESSED AGGREGATES FOR ROAD CONSTRUCTION. The Lecture was chaired by Mr. L R Singh, Secretary, IIM Vijayanagar Chapter and COO, JSW Vijayanagar Works. Mr. Pandey presented the details of the new slag-based road construction guidelines, methodology to convert them into aggregates and testing procedures. He presented the lab testing and site demonstration results. He also highlighted the dire need of alternative slag-based aggregates in the country to continue the growth journey. A video on the inauguration of slag-based demonstration road at NH66 was also released on this occasion.

Mr. Satish Pandey Delivering his Lecture

****

Advertisers' Index	
Name of the Organisations	Page Nos.
Chennai Metco Pvt Ltd	2nd Cover
Star Testing Systems	13
Instron	14
M N Dastur & Company (P) Ltd	15
Hindalco Industries Ltd	19
Mishra Dhatu Nigam Limited	20
JSW Steel Ltd	3rd Cover
Steel Authority of India Ltd	4th Cover

Upcoming Memorial Lectures :

Lecture	Speaker	Date & Venue
Dr. A K Seal Memorial Lecture 2024	 Dr. V. Balasubramanian Professor & Director, CEMAJOR Dept. of Manufacturing Engg. Annamalai University	20^{th} July 2024 at Biswa Bangla Convention Centre, Kolkata
Dr. Daya Swarup Memorial Lecture 2024	 Prof. Debrupa Lahiri Dept. of Metallurgical & Materials Engineering, IIT Roorkee	Between 20^{th} and 22^{nd} November 2024 at Dr. Babu Rajendra Prasad Convention Centre GKVK, Univ. of Agricultural Sciences, Bengaluru.
Prof. NP Gandhi Memorial Lecture 2024	 Prof. Rajesh Prasad Professor, Dept. of Materials Science & Engineering IIT Delhi	Between 20^{th} and 22^{nd} November 2024 at Dr. Babu Rajendra Prasad Convention Centre GKVK, Univ. of Agricultural Sciences, Bengaluru.

****

Achievements

Dr Raghupatruni Bhima Rao

Dr. Raghupatruni Bhima Rao, Member of the Executive Committee of IIM Bhubaneswar chapter was honoured with an international award, FEIAP ENGINEER OF THE YEAR AWARD FOR 2024, by the Federation of Engineering Institutions of Asia and the Pacific [FEIAP]. Dr. Rao holds a Ph.D. in mineral engineering from IIT Dhanbad [formerly known as ISM Dhanbad]. With over 45 years of experience in Research and Academia in Mineral Engineering, his expertise spans comminution, flowsheet developments for various industrial minerals and ores, auditing, and modifications of operational Indian mineral processing industries. Dr. Rao is the Life Member of IIM.

****

Iron & Steel Statistics

World

Crude Steel Production by Region

	Apr 2024 (Mt)	% change Apr 24/23	Jan-Apr 2024 (Mt)	% change Jan-Apr 24/23
Africa	1.8	1.4	7.4	6.6
Asia and Oceania	114.8	-5.8	461.8	-1.6
EU (27)	11.3	1.1	44.4	-0.6
Europe, Other	3.4	-2.6	14.7	13.9
Middle East	4.6	-8.2	18.3	6.2
North America	8.9	-5.2	35.8	-3.7
Russia & other CIS + Ukraine	7.4	-3.5	29.0	-0.6
South America	3.4	-3.9	14.0	1.2
Total 71 countries	**155.7**	**-5.0**	**625.4**	**-0.9**

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

- **Africa :** Algeria, Egypt, Libya, Morocco, South Africa, Tunisia
- **Asia and Oceania :** Australia, China, India, Japan, Mongolia, New Zealand, Pakistan, South Korea, Taiwan (China), Thailand, Viet Nam
- **European Union (27) :** Austria, Belgium, Bulgaria, Croatia, Czechia, Finland, France, Germany, Greece, Hungary, Italy, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden
- **Europe, Other :** Macedonia, Norway, Serbia, Türkiye, United Kingdom
- **Middle East :** Bahrain, Iran, Iraq, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, Yemen
- **North America :** Canada, Cuba, El Salvador, Guatemala, Mexico, United States
- **Russia & other CIS + Ukraine :** Belarus, Kazakhstan, Russia, Ukraine
- **South America :** Argentina, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela

Top 10 Steel-producing Countries

	Apr 2024 (Mt)	% change Apr 24/23	Jan-Apr 2024 (Mt)	% change Jan-Apr 24/23
China	85.9	-7.2	343.7	-3.0
India	12.1	3.6	49.5	8.5
Japan	7.1	-2.5	28.5	-1.2
United States	6.7	-2.8	26.5	-2.2
Russia	6.2 e	-5.7	24.6	-2.5
South Korea	5.1	-10.4	21.2	-5.1
Germany	3.4 e	6.4	13.1	6.1
Türkiye	2.8	4.5	12.3	22.1
Brazil	2.7 e	-2.1	11.0	4.0
Iran	2.7 e	-12.3	10.3	7.2

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

Source : worldsteel.org

NF Metals Statistics

Domestic Scenario

Production (unit : Lakh Tonnes)

	Apr'24	Mar'24	Feb'24	2023 - 24	2022 - 23	2021 - 22
ALUMINIUM						
NALCO	0.36	0.41	0.37	4.63	4.60	4.60
HINDALCO*	1.09	1.13	1.06	13.31	13.22	12.94
BALCO	0.48	0.50	0.46	5.84	5.69	5.80
VEDANTA LTD	1.49	1.54	1.44	17.81	17.22	16.92
TOTAL	**3.42**	**3.58**	**3.33**	**41.59**	**40.73**	**40.26**
*Renukoot, Hirakund, Mahan, Aditya						
ZINC (One major producer)						
HZL	**0.71**	**0.78**	**0.72**	**8.17**	**8.21**	**7.76**
COPPER (Cathode)						
HCL	0	0	0	0	0.000073	0.0062
HINDALCO	0.38	0.38	0.34	3.68	4.07	3.59
SSL	0.06	0.07	0.11	1.41	1.48	1.25
TOTAL	**0.44**	**0.45**	**0.45**	**5.09**	**5.55**	**4.85**
LEAD						
HZL	**0.16**	**0.19**	**0.17**	**2.16**	**2.11**	**1.91**

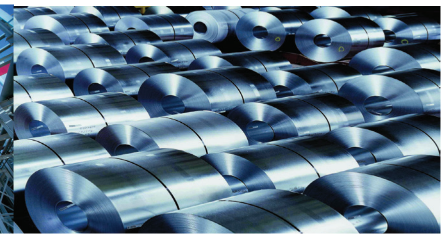
Source : https://mines.gov.in/

Prices in India (as on 9th May, 2024)

(Mumbai Local Price in Rs. / kg)

Product	Rs. / kg	Product	Rs. / kg
Copper Armature	821	Aluminium Ingot	240
Copper Cathod	882	Aluminium utensil	185
CC Rod	876	Zinc Ingot	258
Copper Cable scrap	846	Lead ingot	195
Brass Sheet Scrap	565	Tin Ingot	2973
Brass Honey Scrap	538	Nickel Cathod	1608

Source : https://mtlexs.com/



First Announcement / Call for Papers

Asia Steel 2024

The 9th Asia Steel International Conference

September 4-7, 2024   Changsha, P. R. CHINA

Call for Papers (1st Announcement)

Organized by

The Chinese Society for Metals (CSM)

Sponsored by

The Chinese Society for Metals (CSM)

The Indian Institute of Metals (IIM)

The Iron and Steel Institute of Japan (ISIJ)

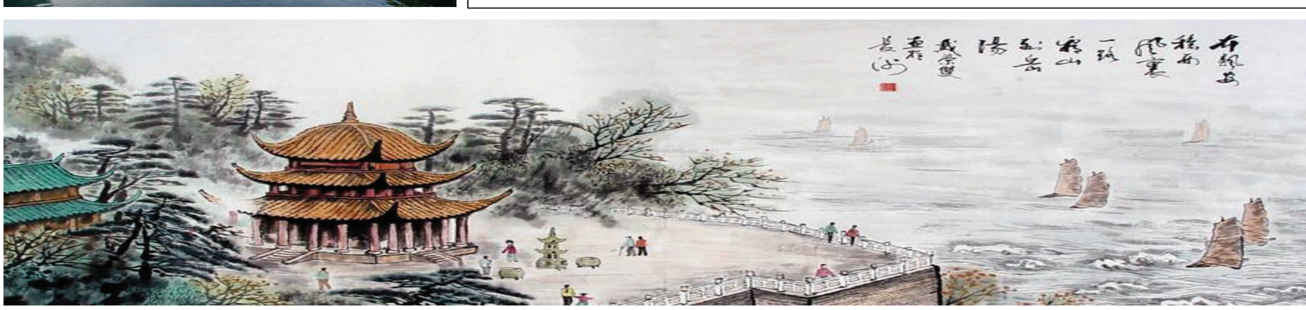
The Korean Institute of Metals and Materials (KIM)

Co-organized by

Hunan Iron & Steel Group Co., Ltd.

中國金屬學會 IIM The Indian Institute of Metals Metallurgy Materials Engineering 一般社団法人 日本鉄鋼協会 The Iron and Steel Institute of Japan KIM The Korean Institute of Metals & Materials

Conference Website: www.asiasteel2024.com



****

INTERNATIONAL BAUXITE, ALUMINA & ALUMINIUM SOCIETY (IBAAS)

IN ASSOCIATION WITH

INDIAN INSTITUTE OF METALS (IIM), GOA CHAPTER

SECOND CIRCULAR
MAY, 2024

IBAAS 2024

IIM Metallurgy Materials Engineering

PRESENTS

12TH INTERNATIONAL BAUXITE, ALUMINA & ALUMINIUM CONFERENCE & EXHIBITION

IBAAS-IIM 2024

ALUMINIUM INDUSTRY-VISION 2030

Birla Institute of Technology & Science, Pilani

K K Birla Goa Campus, Goa

SEPTEMBER 25-27, 2024

IBAAS 2024

Invitation

We are delighted to extend our warm invitation to you for the **12th International Bauxite, Alumina & Aluminium Conference & Exhibition (IBAAS-IIM 2024)**, organised by IBAAS in collaboration with the Indian Institute of Metals (IIM). The conference is scheduled to take place during September 25-27, 2024, at the picturesque location of Goa. The theme of the conference is **"Aluminium Industry – Vision 2030"**.

Objective of the Conference:

- Develop a road map for Bauxite, Alumina and Aluminium industry in India.
- Provide a platform for primary and secondary aluminium producers to share knowledge and review latest developments in the entire value chain of Aluminium Industry.
- Application of Bauxite and Alumina in non-metallurgical industries.
- Aluminium Industry 4.0.
- Decarbonization and Green Aluminium.
- Aluminium recycling industry.

The conference will bring together industry leaders, experts, researchers, professionals, technology providers and equipment manufacturers from the bauxite, alumina, and aluminium sectors to deliberate on the current status of this industry.

Best Regards,
International Bauxite, Alumina & Aluminium Society (IBAAS) & Indian Institute of Metals (IIM)
IBAAS-IIM 2024

International Bauxite Alumina & Aluminium Society | www.ibaas.info | Info@ibaas.info

****


IIM-ATM 2024
IIM Metallurgy Materials Engineering
JSW Steel
78th Annual Technical Meeting of The Indian Institute of Metals
20 – 22 November 2024
Bengaluru
Venue
Dr. Babu Rajendra Prasad International Convention Centre, Gandhi Krishi Vignan Kendra (GKVK) University of Agricultural Sciences, Bengaluru
Organizers
IIM Vijayanagar Chapter, IIM Bangalore Chapter, IIM Dolvi Chapter, IIM Salem Chapter in association with JSW Steel Ltd.
6366919274
iim.atm2024@jsw.in
www.iimatm.in

Call for Abstracts

Prepare to seize a golden opportunity by submitting your abstract for presentation at the IIM ATM 2024. This prestigious event offers a platform to showcase your groundbreaking research and insights to an esteemed audience, including fellow researchers, academicians, industry experts, and policymaker. Whether you opt for an oral presentation or a poster display, your work will garner the attention it deserves, fostering collaboration, exchange of ideas, and potential partnerships. Abstracts are invited for technical sessions covering the entire spectrum of Metallurgy and Materials Science.

Your abstract, up to 500 words in length and written in English, can be submitted electronically in MS Word format. We do not accept submissions via mail or fax. Ensure adherence to submission guidelines by downloading the abstract submission template from our website.

Don't miss this opportunity to contribute to the advancement of metallurgy and materials science while engaging with peers and industry professionals. Submit your abstract today and be part of this exciting event.

The major topics will encompass a wide range, including but not limited to;

- Mineral Processing – Ferrous, Non-ferrous and Coal
- Ironmaking and Steelmaking
- Non-ferrous Metal Processing
- Solidification and Casting
- Metal Forming - Hot Rolling, Cold Rolling, Forging and Drawing
- Metal Joining – Ferrous and Non-ferrous
- Powder Metallurgy and Additive Manufacturing
- Bio-Materials, Smart Materials and Functional Materials
- Integrated Computational Materials Engineering (ICME), Modeling and Simulation
- Digitalization and Industry 4.0
- Structure Property Correlation
- Failure Analysis
- Environment and Sustainability
- Refractories, Ceramics and Composites
- Materials for Strategic Sectors – Defence, Nuclear and Aerospace
- Corrosion, Electrochemistry, Batteries and Fuel Cells
- Archaeo-metallurgy

Abstract Format

Font: Times New Roman
Size: 12
Title: Centered, Bold
Authors: Centered, Underlined the presenter, Single-space
Affiliation : Centered, Single-Space
E-mail address: Author's e-mail address
Contact Number: Author's contact number
Abstract: Single-space within paragraph, Double-space between paragraphs, Image inserts acceptable, 1 inch margin on four sides
Word limit: 500 words
Keyword: Maximum 5 words

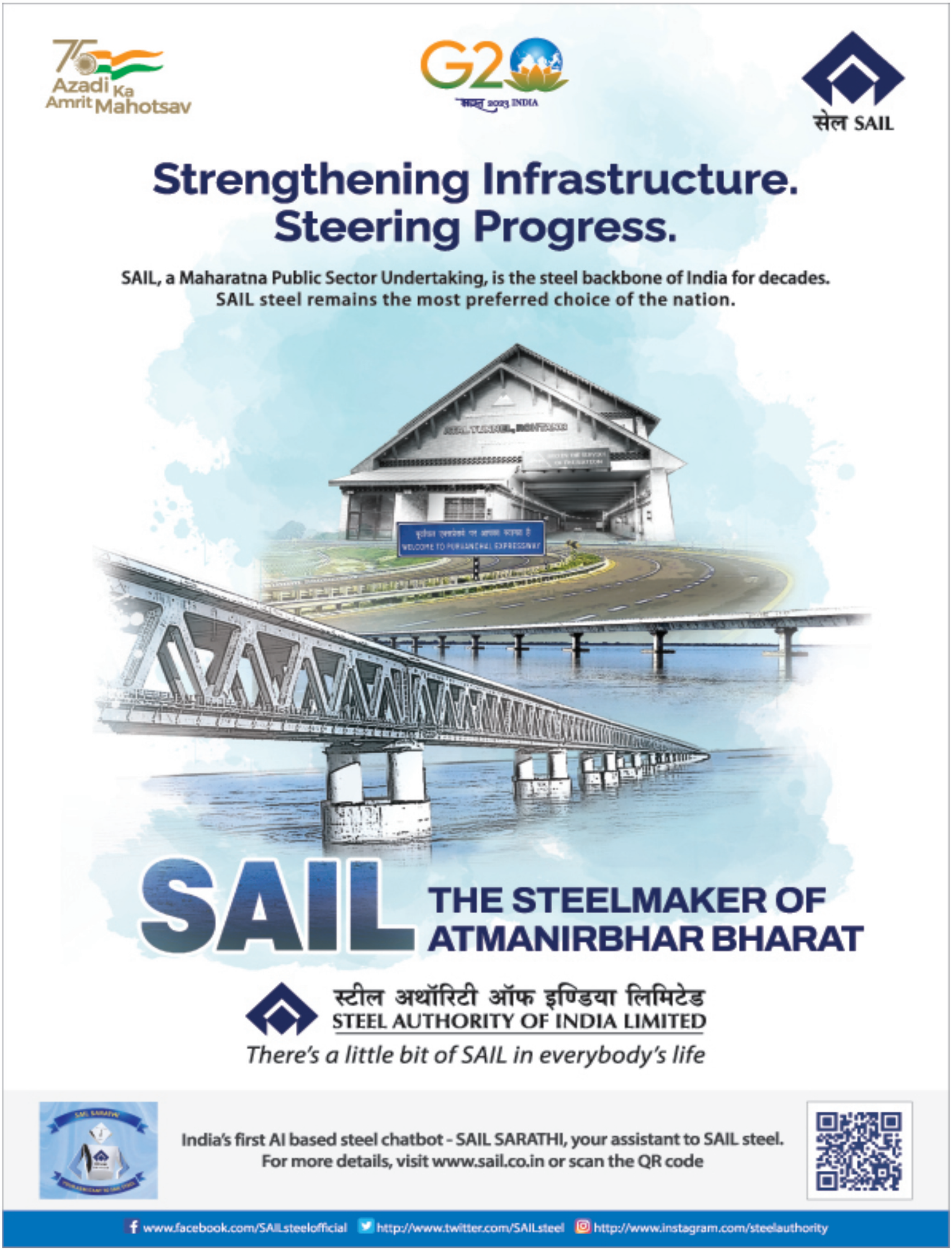
Important Points

- To submit abstracts, please create an account in the website and upload your abstract in accordance with the submission guidelines
- Authors receive notification of acceptance in August
- All speakers and interested participants must register for the event by paying the prescribed registration fees through the registration link in the website
- To ensure a smooth process, we recommend early registration

Outstanding oral and poster presentations from each session and theme will be recognized and awarded during the event. More numbers of student participation is anticipated. Exciting prizes will be presented to PG/UG students for their distinctive work in materials and manufacturing sector.

Last Date for Submission of abstracts: 31st July 2024

Submit Abstract at www.iimatm.in


Azadi Ka Amrit Mahotsav
G20
सेल SAIL
Strengthening Infrastructure.
Steering Progress.
SAIL, a Maharatna Public Sector Undertaking, is the steel backbone of India for decades.
SAIL steel remains the most preferred choice of the nation.
SAIL
THE STEELMAKER OF ATMANIRBHAR BHARAT
स्टील अथॉरिटी ऑफ इण्डिया लिमिटेड
STEEL AUTHORITY OF INDIA LIMITED
There's a little bit of SAIL in everybody's life
India's first AI based steel chatbot - SAIL SARATHI, your assistant to SAIL steel.
For more details, visit www.sail.co.in or scan the QR code
www.facebook.com/SAILsteelofficial
http://www.twitter.com/SAILsteel
http://www.instagram.com/steelauthority