ISSN 0972-0480 • Vol. 27 No. 3 • March 2024

IIM METAL NEWS

A monthly publication of The Indian Institute of Metals

TATA STEEL
#WeAlsoMakeTomorrow

TATA

THE ROAD TO A GREENER TOMORROW BEGINS WITH UPCYCLING

Tata Aggreto and Tata Nirman's solutions developed from steel by-products are contributing to landmark projects such as National Highway 33 connecting Ranchi and Jamshedpur. These solutions provide a sustainable and durable alternative to natural aggregates. They also reduce the need for mining, protecting biodiversity. Sure, we make steel.

But **#WeAlsoMakeTomorrow**.

Building a sustainable road for a greener tomorrow

NH 33 (Package IV), Ranchi – Jamshedpur

IIM METAL NEWS

Vol. 27 No. 3 March 2024

Chief Editor
Prof K Bhanu Sankara Rao

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@gmail.com
iimmetalnews@yahoo.com
Phone: 033-2367 9768 / 2367 5004
Website: www.iim-india.net
Fax: (033) 2367 5335
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

Upcoming Event

THE INDIAN INSTITUTE OF METALS

PATRONS

Mr R M Dastur — Dr Baba Kalyani

ADVISORY COMMITTEE OF FORMER PRESIDENTS

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

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
Dr Nagamani Jaya Balila
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
Prof Sushil K 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

Fatigue Crack Growth Behaviour of AL Alloy 2024 T3 at High Temperatures

R Srilakshmi[1]

Abstract

Aluminum alloy stands out as a premier material in automotive, aircraft and heavy industries, prized for its lightweight nature, formidable strength, high elastic modulus, excellent electrical conductivity, and thermal resilience. Even as fatigue strength and other properties diminish, structural components like fuselages, wings, heat exchangers and aircraft turbines are mandated to operate safely under these demanding conditions.

In the present work, fatigue behaviour of Al 2024 T3 alloy has been carried out. The specimens are fabricated by means of wire cut electro discharge machining. The initial edge notch is introduced. The obtained specimens are tested under constant cyclic loading at room temperature and elevated temperatures at 100°C and 200°C. It is found that the fatigue life of the plate at room temperature is more than that at elevated temperatures. Fatigue strength of plate decreases with increasing temperature. Further, the fractrographic analysis of failed samples have been performed using Scanning electron microscope (SEM). The three regions of fatigue crack growth are predicted using SEM at different magnifications. From the obtained images it is found that the fractures surface is with unresolved sitrations i.e., in the region-1 and at high stress level with resolved striations and final failed surface.

Keywords : Fatigue, High temperature, Crack growth, Scanning electron microscope.

1. Introduction

Aluminium alloy of 2024 T3 grade widely regarded as a top-tier material across the aerospace field, valued for its lightweight construction robust strength, resilience to thermal strain, and high modulus [1,2]. Due to these attributes significantly shape cost, performance, and manufacturing considerations. Moreover, engineered components must meet anticipated standards and safety margins under varied operating conditions. The examination of fatigue assumes paramount importance due to the potential for catastrophic failure resulting from cyclic loading and unloading over time. Understanding fatigue behaviour is crucial for foreseeing changes in material properties and accrued damage throughout its service life[3]. Several factors, such as shape, size, fatigue strength and surface finish, hold pivotal roles in defining the characteristics of structural components. There is few literature studies exists on fatigue behaviour of cracked al alloy panel at room temperatures. Yin et al. [4] have carried out the fatigue crack growth(FCG) performance of 2524 al alloy by varying grain size. They have predicted the metallographic behaviour of crack propagation in different samples with different grain sizes using scanning electron microscope. Antunes et al.[5] have performed numerical investigation of FCG behaviour of al alloy by finding plastic crack opening displacement. They have compared their results with experiments. They found that crack closure is the main cause of change in crack growth rate *da/dN*. The effect of corrosion environment on FCG behaviour has been performed experimentally by few authors[6,7]. Bang et al. [8] have carried out the numerical and experimental analysis of fatigue crack growth behaviour of small and long crack. They has been developed a model to predict nonlinearities in crack propagation, utilizing a regression method that considers both small and long crack behaviours. The predicted crack growth rates are correlated with the experimental data. Yadav et al.[9] have performed the experimental analysis of fatigue behaviour o friction stirred

[1]Department of Mechanical Engineering , SVNIT, Surat, Gujarat
Email : ***Srilakshmi_r@med.svnit.ac.in***

welded al alloy plates by varying mean stresses and varying R ratio. They found that the fatigue life of welded components was notably shorter compared to the base metal, despite having comparable tensile strength, attributable to the variability in microstructure across the weld section. Zhang et al. [10] have investigated pre-corrosion and post corrosion fatigue crack growth rate of 2024 T4 Al alloy. They have predicted out fracture morphology test using scanning electron microscopy (SEM), while the corrosion products was analyzed through energy dispersive spectroscopy (EDS). Recently, Robles et al.[11] have carried out the theoretical and experimental analysis of fatigue crack growth in Al 2024 T351. There is significant literature exists on fatigue crack growth behaviour of al alloy panel at room temperature. All the above studies have not explained about the fatigue crack behaviour at high temperatures. Syed et al.[12] have performed experimental FCG analysis of cracked and repaired panel under thermal cycling load. There are few more literature exists on high temperature FCG behaviour of aluminium alloy plates [13-17]. They have not carried out the experimental FCG analysis of 2024 T3 Alloy at high temperatures.

In the present work, fatigue behaviour of Al 2024 T3 alloy has been carried out. The specimens are fabricated using wire cut electro discharge machining. The initial edge crack is made using EDM. The obtained specimens are tested under constant amplitude cyclic loading at room temperature and elevated temperatures at 100°C and 200°C. It is found that the fatigue life of the plate at room temperature is more than that at elevated temperatures. Fatigue strength of plate decreases with increasing temperature. Further, the fractrographic analysis of failed samples has been carried out using SEM. The three regions of fatigue crack growth are predicted using SEM at different magnifications. From the obtained images it is found that the fractures surface is with unresolved striations at low stress level i.e., in the region-1 and at high stress level with resolved striations.

2. Experimental Methods

The specimens are made as per the dimensions as shown in Fig.1(a) [12] using wire cut electro discharge machining. A 3 mm notch is introduced in the specimen which is shown in Fig.1(b). Initially, the tensile test is conducted to estimate the ultimate strength of the material. The properties obtained are given in Table.1.

To predict the fatigue crack initiation and growth behaviour using scanning electron microscope, the aluminium alloy 2024T3 plates are tested at room temperature and high temperatures such as 100°C

Table.I: Material Properties of Al 2024 T3 Alloy

Property	Value
Ultimate strength	417MPa
Yield strength	338MPa
Young's modulus	70.9Gpa

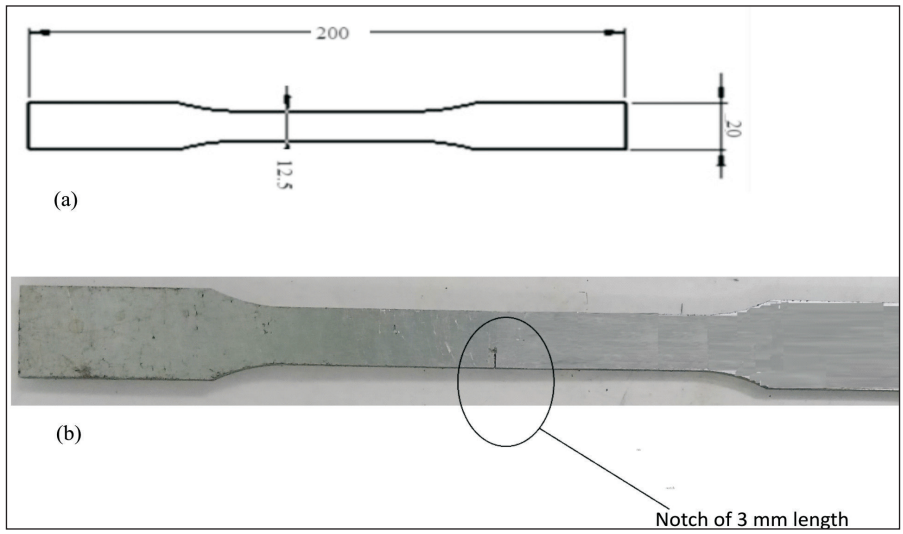


Fig. 1 : a) Schematic of Test specimen b) Test specimen with notch

and 200°C. The thickness of the specimen is 3 mm. The specimens were tested in MTS axial fatigue testing machine of 100kN at room temperature under constant amplitude cyclic loading at *R* ratio of 0.1 and maximum load of 20% of ultimate load is taken as 3kN and minimum load is of 0.3kN at frequency of 5Hz. The fatigue life of the notched specimen is estimated at room temperature, and at high temp temperature. In general, the fatigue process is divided into three distinct regions [15].

Region I is characterized by the propagation of cracks at low ΔK levels, which is widely recognized as a significant contributor to the overall fatigue life of a structure. Region II has garnered considerable attention, as it is here that the 'Paris' crack growth law (eq.1) is applicable, expressed as:

$$\frac{da}{dN} = C(\Delta K)^m \qquad (1)$$

Where C, m are experimentally derived constants. Region III is marked by rapid crack growth and is typically considered to constitute only a small portion of the total life. Throughout the fatigue process, the material undergoes physical alterations, leaving marks on the fracture surfaces. Following material failure, these marks offer valuable insights. Further the fractography study of the specimen is carried out using scanning electron microscope.

3. Results and Discussions

3.1 Stress vs Number of cycles

Figure.2 shows the variation of fatigue life w.r.t displacement. The relationship between the number of fatigue cycles and displacement depends on the material, loading conditions, and other factors. Fatigue life of the specimen at room temperature is more as compared to elevated temperatures as mentioned in Table. II. loading, which can lead to failure over time. From the Fig.1 at the low displacements, the fatigue life increased by 16% to 85%. Moreover, the fatigue crack growth rateof sample is decreasing with rise in temperature. The fatigue life of sample at 100 °C was 18,000 cycles.

Table.II: Fatigue life cycles of Al 2024 T3 Alloy at different temperatures

Temperature	Number of cycles
Room Temperature (24°C)	24862
100°C	18680
200°C	16317

3.2 SEM examination

In the present study, an extensive post-fracture fractographic analysis of the fatigue samples at room temperature and at temperatures such as 100°C and 200°C. The images are captured by using SEM made by ZESIS commercially available at IITB.

Below Fig.3 shows the image of different regions of crack growth such as crack initiation, crack growth and final fracture. In Fig.3 the R1 represents the fracture surface at low stress level which is known as crack initiation state, the R2 represents the crack growth region and the R3 represents the final failure region.

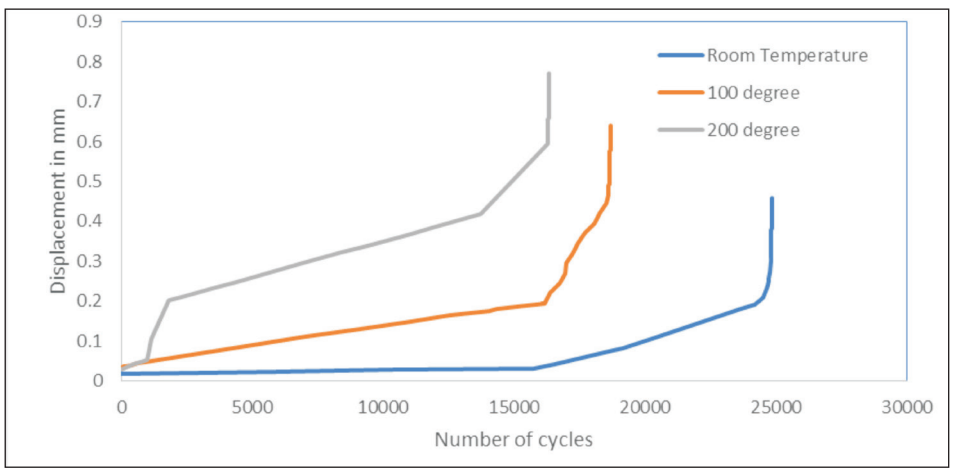


Fig. 2 : Variation of number of cycles w.r.t. displacement

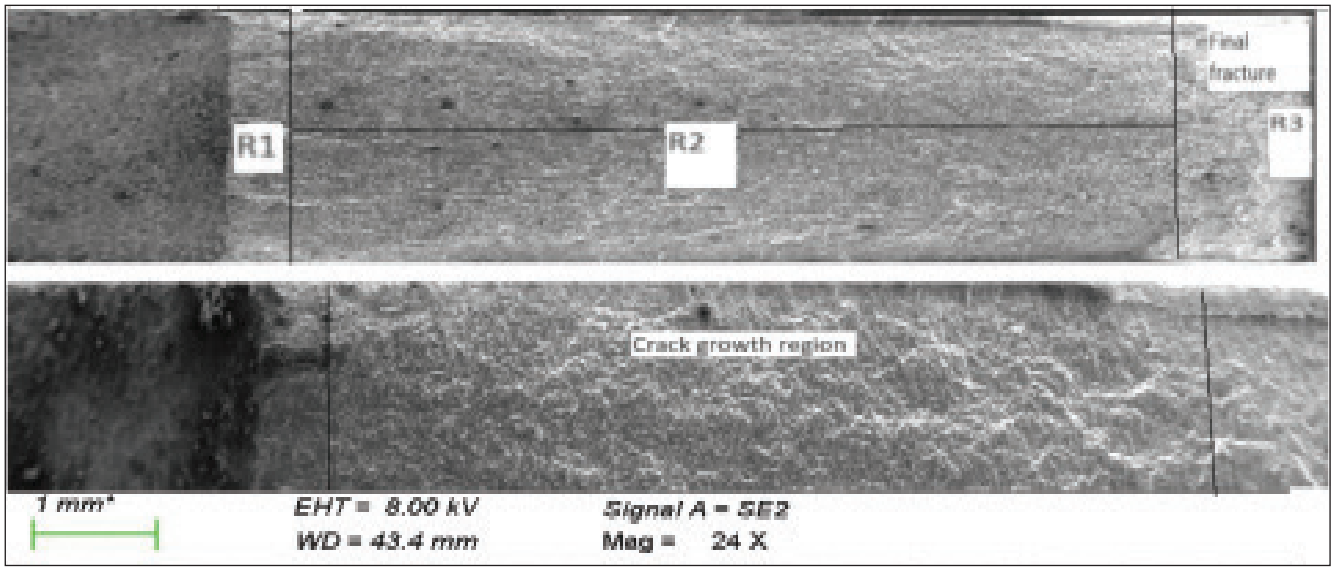


Fig. 3 : Image of Fractured surface of the room temperature tested sample

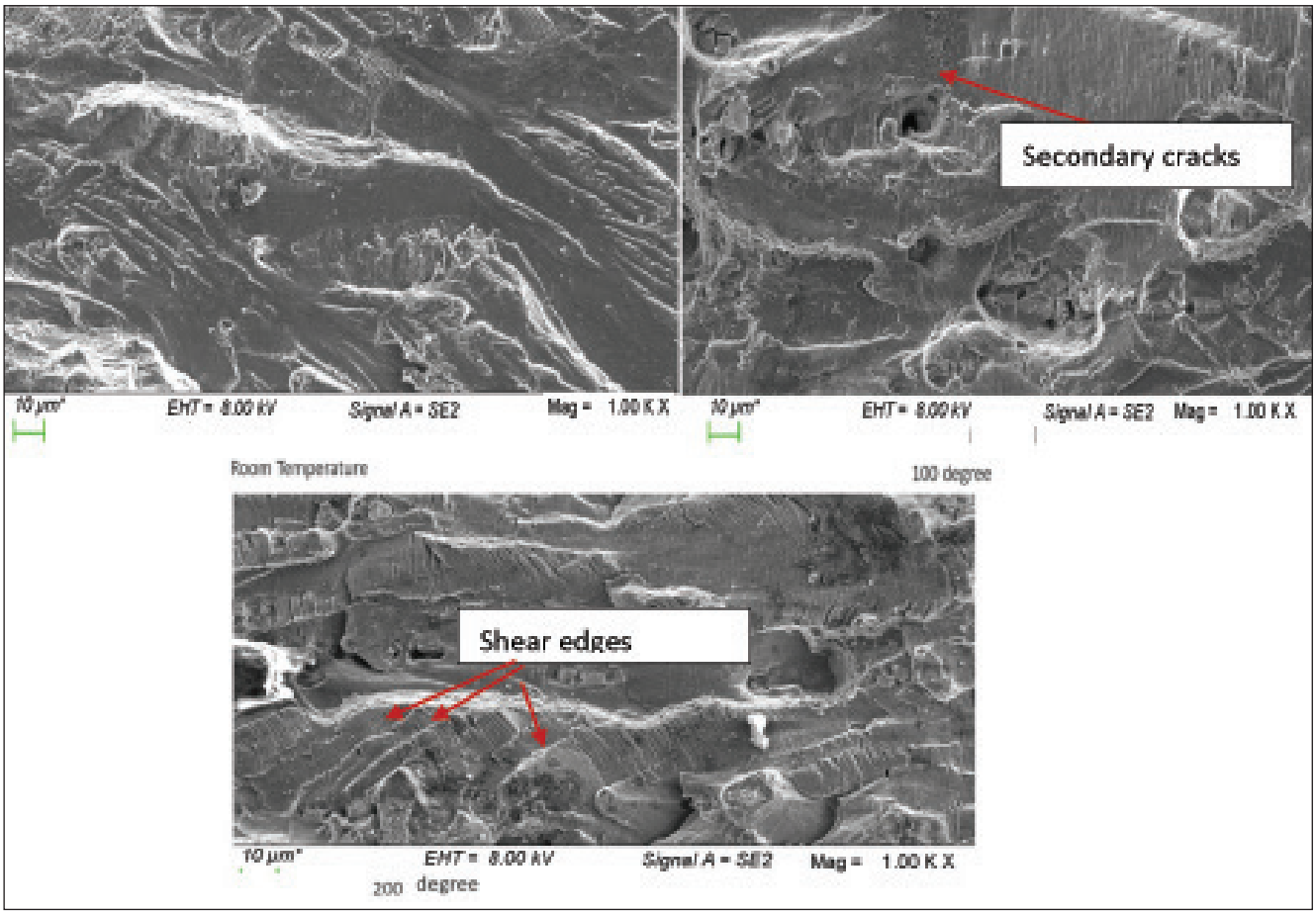


Fig. 4 : SEM images at region R1 of Failed samples at room temperature, 100 degree and 200 degree

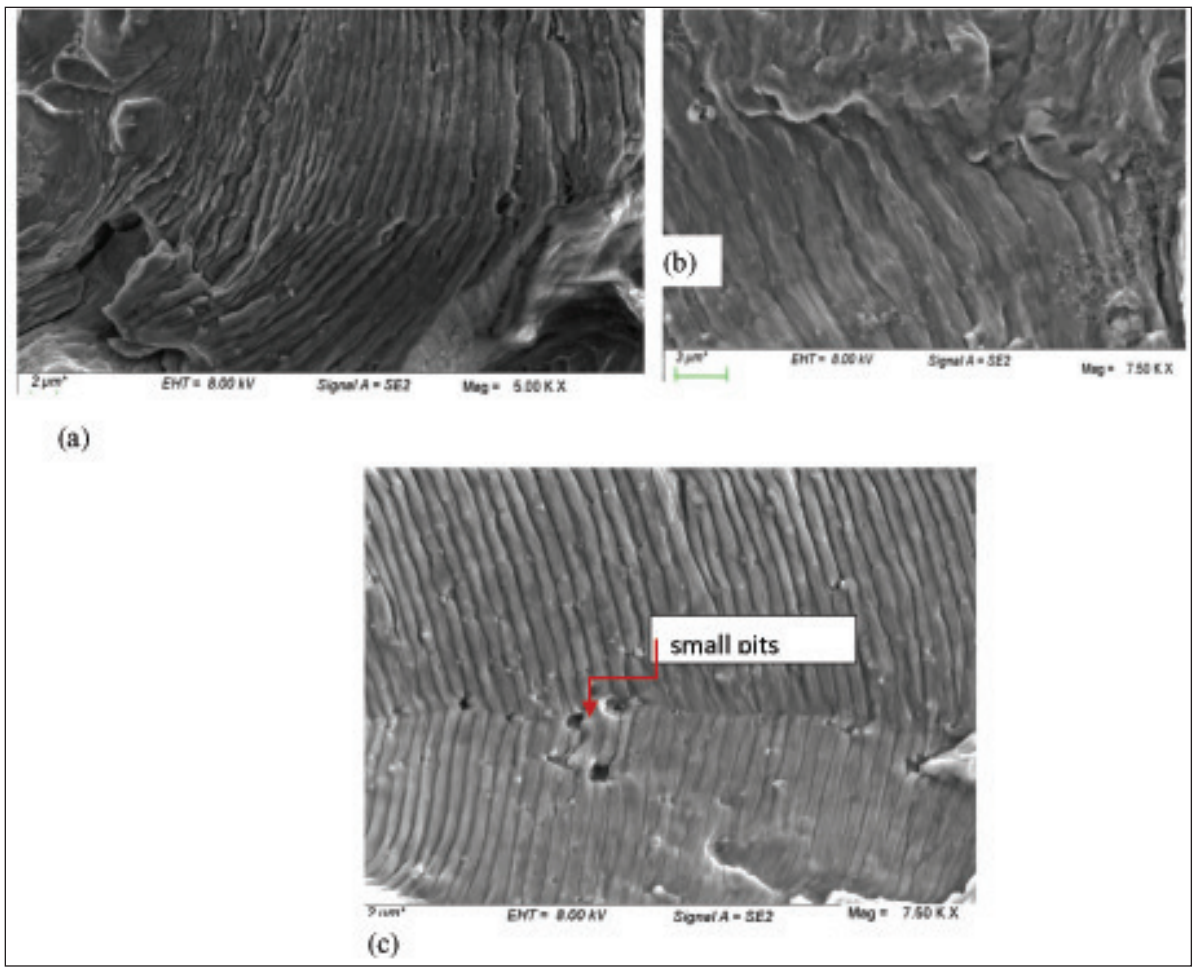


Fig. 5 : SEM images at region R2 of Failed samples at a) room temperature , b)100 degree c)200 degree

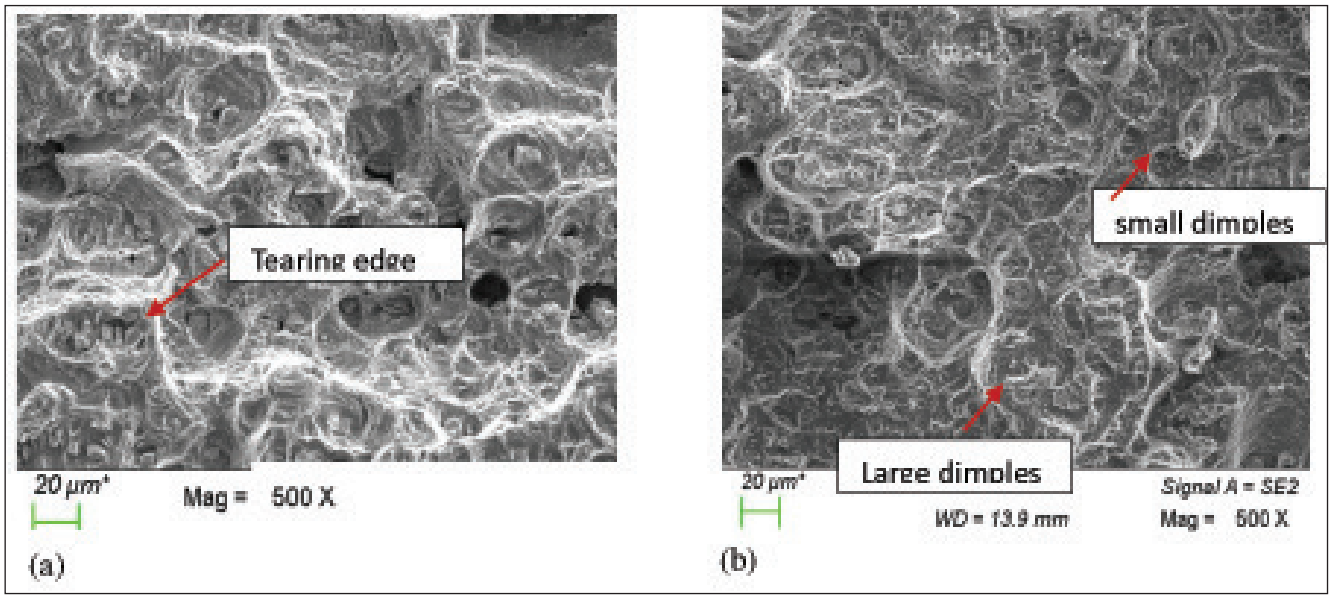


Fig. 6 : SEM images at region R3 of Failed samples at a) room temperature , b)200 degree

Fig.4 depicts micrographs captured from region I, revealing a morphology indicative of localized intra-granular fracture. Notably, fatigue striations were not distinctly visible in this area, yet the initiation of micropores, secondary cracks, and shearing edges were discernible. Moving to Fig. 5, it illustrates the micro morphology of stable crack growth in region-2. The trans-granular fracture mechanism will be seen in the region-2. In the Fig.5, fatigue striations are evident in the crack propagation zone in three specimens, with observable variations in striation spacing across samples subjected to different temperatures. Specifically, the spacing of striations reflects the stress effect on fatigue-crack propagation. Remarkably, Fig. 5 highlights that the spacing of striations is reduced in room temperature-tested samples compared to those tested under 100°C, suggesting increased brittleness, thereby reducing the likelihood of fatigue streaks. However, the impact of the interaction between growing fatigue crack and micro structural features appeared insubstantial. Notably, small pits were formed in specimens tested at 200°C. Furthermore, it was observed that elevated temperature significantly alters the shape of inclusions, rendering them more oval-shaped and closely sized compared to those obtained at lower temperatures. Consequently, this alteration contributes to additional weakening of the material. Microscale analysis revealed that elevated temperature induces uniformity in the size of dimples on the fracture surface, regardless of notch radii. Moreover, a greater abundance of dimples was observed at higher temperatures than at room temperature.

4. Conclusion

The experimental fatigue crack growth analysis of edge cracked panel is carried out at room temperature and elevated temperature such as 100°C and 200°C. The following observations are made from the study:

I. The Fatigue life of flat plate with edge crack decreases with increase in temperature.

II. From the fractrography study, the three regions of fatigue crack growth such as initiation, crack propagation and final fracture are identified. The fracture appearance of room temperature specimen is different from the specimen tested at high temperature.

III. In crack propagation region (R2), the trans-granular fracture surface is observed. Formation of small pits is observed in high temperature tested specimen.

IV. In the region 3, the morphology observed is of small and large dimples.

5. Acknowledgement

I acknowledge IITBombay AMFT lab and MMMF lab for allowing to carryout the fatigue experiments and SEM Characterisations.

6. References

1) Lankford J. The growth of small fatigue cracks in 7075–T6 aluminum. Fatigue Fract Eng Mater Struct 5(1982) 233–48.

2) Citarella R, Carlone P, Lepore M, Palazzo GS. Numerical–experimental crack growth analysis in AA2024-T3 FSWed butt joints. Adv Eng Soft 80 (2015) 47–57.

3) Dursun T, Soutis C. Recent developments in advanced aircraft aluminium alloys. Mater Des.56 (2014) 862-874.

4) Deyan Yina, HuiqunLiua, YuqiangChenc, Danqing Yi, Bo Wanga, Bin Wanga, Fanghua Shena, Shang Fua,Cong Tanga,Suping Pana. Effect of grain size on fatigue-crack growth in 2524 aluminium alloy. International Journal of Fatigue 84 (2016) 9–16.

5) F.V. Antunes, S. Serrano, R. Branco, P. Prates. Fatigue crack growth in the 2050-T8 aluminium alloy. international journal of fatigue 115 (2018)79-88.

6) Chen Y, Tang Z, Pan S. The fatigue crack growth behaviour of 2524 T3 aluminium alloy in an Al2O3 particle environment. Fatigue Fract Eng Mater Struct. (2020) 1–14.

7) DanyilKovalova, Balázs Feketeb, George R. Engelhardtc, Digby D. Macdonaldb. Prediction of corrosion fatigue crack growth rate in alloys. Part II: effect ofelectrochemical potential, NaCl concentration, and temperature on

crack propagation in AA2024-T351. corrosion science 152(2019)130-139.

8) D.J. Bang, A. Ince, M. Noban. Modeling approach for a unified crack growth model in short and long fatigue crack regimes. International Journal of Fatigue 128 (2019) 105182.

9) Vinay Kumar Yadav, Vidit Gaur, I.V. Singh. Combined effect of residual and mean stresses on fatigue behavior of welded aluminum 2024 alloy.International Journal of Fatigue 155(2022) 106565.

10) Tianyu Zhang , Yuting He ,Changfan Li ,TengZhang and Sheng Zhang. Effect of Alternate Corrosion and Fatigue on Fatigue CrackGrowth Characterization of 2024-T4 AluminumAlloy. Mathematical Problems in Engineering (2020) 1-15.

11) J.M. Robles,J.M. Vasco-Olmo, , A.S. Cruces, F.A. Diaz, , M.N. James , P. Lopez-Crespo. Fatigue crack characterisation in 2024-T351 aluminium alloy through SEM observation combined with the CJP model. International Journal of Fatigue 166 (2023) 107279.

12) Abdul Khadar Syed, Xiang Zhang, James E. Moffatt, Michael E. Fitzpatrick. Effect of temperature and thermal cycling on fatigue crack growth in aluminium reinforced with GLARE bonded crack retarders.International Journal of Fatigue 98 (2017) 53–61.

13) Shahan Mazlan, NoorfaizalYidrisand Michal Petru. Experimental and Numerical Analysis of Fatigue Life ofAluminum Al2024-T351 at Elevated Temperature. Metals 2020, 10, 1581;

14) Phalgun Nelaturu,Saumyadeep Jana, Rajiv S. Mishra, Glenn Grant, Blair E. Carlson. Effect of temperature on the fatigue cracking mechanisms in A356 Al alloy. Materials Science & Engineering Part A 780 (2020) 139175.

15) V.N. Shlyannikov, R.R. Yarullin, I.S. Ishtyryakov. Effect of temperature on the growth of fatigue surface cracks in aluminum alloys. Theoretical and Applied Fracture Mechanics 96 (2018) 758-767.

16) R. Srilakshmi, M. Ramji, Viswanath Chinthapenta. Fatigue crack growth study of CFRP patch repaired Al 2014-T6 panel having an inclined center crack using FEA and DIC. Engineering Fracture Mechanics 134 (2015) 182–201

17) Hussain.FAbdullah.S, Nuawi.M. Effect of temperature on fatigue life behaviour of aluminium alloy AA6061 using analytical approach. J. Mech. Eng. Sci. 10 (2016) 2324–2335.

****

Modification in IIM Membership wef 1st April 2024

Changes in Membership Categories wef 01.04.2024	
Existing Membership Categories	**Revised Membership Categories**
Patron	Patron
Donor	Donor
Sustaining (Large Scale)	Donor (Annual)
Sustaining (Small Scale)	
Life	Life
Life Associate	Eliminated
Member	Member
Associate	Eliminated
Professional	Professional
Student	Student

Revised Membership Fees wef 01.04.2024	
Category	**Amount**
NEW - PATRON MEMBER - ONE TIME	2,50,000
NEW - DONOR MEMBER - ONE TIME	1,50,000
NEW - DONOR MEMBER - ANNUAL	15,000
NEW - LIFE MEMBER - ONE TIME	15,350
NEW - MEMBER - ANNUAL	1,850
NEW - MEMBER (RETIRED) - ANNUAL	1,100
NEW - PROFESSIONAL MEMBER - ONE TIME	15,450
NEW - STUDENT MEMBER - FOR 3 YEARS	EXEMPTED
EXISTING - DONOR MEMBER - RENEWAL	15,000
EXISTING - MEMBER - RENEWAL	1,500
EXISTING - MEMBER (RETIRED) - RENEWAL	750
PROMOTION - MEMBER TO LIFE MEMBER	15,000

Changes in Membership Eligibility Criteria	
Category	**Eligibility Criteria**
"Patron Member"	No Changes in Eligibility Criteria
"Donor Member"	No Changes in Eligibility Criteria
"Life Member"&"Member"	Shall hold the bachelor's Degree in Metallurgy or equivalent discipline from an Institute recognised by the Council or should have passed Parts I and II Examinations held by the IIM OR Shall hold a Master's Degree in Metallurgy or equivalent degree recognised by the Council OR Shall hold a Bachelor's Degree in Engineering disciplines other than Metallurgy or equivalent or a Master's Degree or Doctorate in Physics or Chemistry or Geology OR Shall be a Diploma Holder in Metallurgy with at least 3 years experience OR Shall be a Diploma Holder in Engineering other than Metallurgy/B.Sc. with Physics, Chemistry, Mathematics/ Geology and at least 3 years experience OR Shall hold a Degree from a recognised University and shall be proposed.
"Professional Member"	No Changes in Eligibility Criteria
"Student Member"	Student Member Studying Bachelor's Degree in Engineering / Studying Diploma in Metallurgy / Studying B.Sc. with Physics, Chemistry, Mathematics/Geology / M. Tech. (Dual Degree) Can be a student member till completion of Degree. Student Affiliate Member A member of a Student Affiliate Chapter of the Institute.

****

News Updates Domestic

India likely to witness slower growth in steel consumption in FY25: Icra

India's domestic steel consumption growth is likely to come down to 7-8 per cent in the next financial year against an estimated 12-13 per cent this fiscal due to moderate government spending during the election period, Icra said in a report. Elevated input costs, import pressures, along with softer steel prices are expected to sequentially pull down the steel industry's operating profit margins by 110-115 basis points in FY2025, the ratings agency said.

The domestic steel consumption could decelerate to 7-8 per cent in FY 2024-25 after three back-to-back years of double-digit growth, it said.

As per Icra, the demand in the ongoing 2023-24 fiscal is estimated to be in the range of 12-13 per cent while the growth of demand was 14.5 per cent in 2022-23 financial year, and 13.3 per cent in the preceding year.

Jayanta Roy, Senior Vice-President & Group Head, Corporate Sector Ratings, Icra said, "In the six-month period between June and November of 2023, as the government accelerated infrastructure spending ahead of the union elections, domestic steel demand grew at a brisk pace of around 16 per cent over the same period of last fiscal."

However, the prints for December 2023 and January 2024 reveal a marked slowdown in consumption growth.

While these are early trends, these numbers nonetheless hint at demand remaining soft over the next two quarters as the government spending moderates around the election period, he said.

On the cost side, coking coal, which Indian mills largely import, remains the largest cost component for a primary steel producer, accounting for 40-45 per cent of the overall cost, followed by iron ore at 10-15 per cent, Icra said.

The Economic Times (07.03.2024)

Govt initiates anti-dumping probe into import of aluminium foil from China

India has initiated an anti-dumping probe into the import of aluminium foil, used as a packaging material for conservation and preservation of edible and food products, from China following a complaint by domestic players.

The commerce ministry's investigation arm, Directorate General of Trade Remedies (DGTR), is probing the alleged dumping of aluminium foil.

Hindalco Industries, Shyam Sel & Power Ltd, Shree Venkateshwara Electrocast, Ravi Raj Foils, GLS Foils Product and LSKB Aluminium Foils have filed the application on behalf of the domestic industry seeking the probe.

They have alleged dumping of the product from China.

The directorate, in a notification, has said that the applicants have provided prima facie evidence with respect to the injury suffered by the domestic industry because of the dumped imports.

“The authority hereby initiates an anti-dumping investigation into the alleged dumping and consequent material injury to the domestic industry,” it said.

If it is established that the dumping has caused material injury to domestic players, the DGTR would recommend the imposition of anti-dumping duty on the imports.

The finance ministry takes the final decision to impose duties.

Anti-dumping probes are conducted by countries to determine whether domestic industries have been hurt because of a surge in cheap imports.

As a countermeasure, they impose these duties under the multilateral regime of the Geneva-based World Trade Organization (WTO). The duty is aimed at ensuring fair trading practices and creating a level-playing field for domestic producers vis-a-vis foreign producers and exporters.

India has already imposed anti-dumping duty on several products to tackle cheap imports from various countries, including China.

Bussiness Standard (26.03.2024)

Domestic non-ferrous metal to post stable earnings in FY25, demand growth to remain healthy at ~10%, says ICRA

The domestic non-ferrous metal industry would post a stable earnings in FY2025, considering steady movement in realisations and an easing of input cost pressure to an extent, said a report by ICRA. The domestic demand growth, it added, is expected to remain healthy at ~10 per cent in FY2025 and would significantly outpace the expected growth of ~2 per cent in global demand. The operating margin of domestic players is also likely to remain stable at 17-17.5 per cent in FY2025, similar to the levels estimated in FY2024. As a result, ICRA maintains a Stable outlook on the sector.

Jayanta Roy, Senior Vice-President and Group Head, Corporate Sector Ratings, ICRA, said, "With input costs remaining largely under check, the domestic entities are expected to register operating margins of 17-17.5 per cent in FY2025, like the levels estimated in FY2024. That said, with the commodity upcycle moderating since FY2023, domestic entities' cash flows have reduced from their record highs, thus increasing their dependence on external financing to meet their committed expansion plans. This trend has been visible from the 13.8 per cent and 14.3 per cent growth in the sector's bank borrowings in FY2023 and FY2024 respectively. Therefore, the industry's leverage (total debt to operating profits) has steadily increased from 1.8 times in FY2023 to ~2.2 times in FY2024 and FY2025. However, these leverage levels are lower compared to the FY2016-FY2020 average of ~3.5 times reported during the pre-Covid era. At the current level, the industry would remain resilient to project-related risks".

On the domestic front, the apparent consumption growth for non-ferrous metals remained healthy at ~10-13 per cent in 9M FY2024 supported by the Government's thrust on infrastructure development and favourable demand from the renewables/ electric vehicle sectors. ICRA said that while the demand is expected to remain soft over the next two quarters with the general elections in picture, the overall demand growth is expected to remain comfortable at ~10 per cent in FY2024 and FY2025.

In addition, the moderation in coal costs, if sustained, is expected to alleviate input cost pressures to an extent. ICRA notes that the domestic e-auction premia on coal had eased in recent months to ~40 per cent in February 2024 from the exorbitant levels of >180 per cent seen in the corresponding period of the previous year. The prices of caustic soda and calcined pet coke also moderated in the current fiscal.

Financial Express (27.03.2024)

Vedanta's BALCO, first Indian company to be certified with ASI Performance Standard

Chhattisgarh-based Bharat Aluminium Company Limited (BALCO), a unit of Vedanta Aluminium, has emerged as the first Indian company to achieve the Aluminium Stewardship Initiative (ASI) Performance Standard V3 Certification for the manufacture and supply of a wide range of primary aluminium products at its facility in Korba.

This includes a smelter with two potlines for producing molten aluminium (hot metal), three cast-houses for shaping the aluminium, a rolled product plant and a power generation plant. Together, they contribute to an annual production capacity of 575,000 tonnes at Balco.

The ASI Certification program was developed through an extensive multi-stakeholder consultation process and is the only comprehensive voluntary sustainability standard initiative for the global aluminium value chain. The ASI Performance Standard V3 defines 11 principles and 62 criteria under three sustainability pillars — Environment, Social, and Governance - with the aim to address sustainability areas in the aluminium value chain, such as biodiversity, indigenous peoples' rights, circularity and greenhouse gas emissions.

The New Indian Express (27.03.2024)

Adani makes metals debut as copper unit begins operations

Adani Enterprises commissioned the first unit of its

copper refinery at Mundra in Gujarat, marking its debut in the metals space through subsidiary Kutch Copper.

Adani Enterprises will invest $1.2 billion to set up the first phase of the copper smelter, with an annual capacity of 500,000 tonnes. The second phase will also add 500,000 tonnes, making Kutch Copper the world's largest single-location custom copper smelter post completion of both the phases, the company said.

"With Kutch Copper commencing operations, the Adani portfolio of companies is not only entering the metals sector but also driving India's leap towards a sustainable and atmanirbhar (self-reliant) future," Gautam Adani, chairman of the group said. The project is likely to create 2,000 direct and 5,000 indirect jobs. It is also expected to have the lowest carbon footprint in its class.

"We believe the domestic copper industry will play a crucial role in achieving our nation's goal of carbon neutrality by 2070 by strengthening our green infrastructure hand in hand with mature environmental stewardship," Adani said.

Copper demand is India is likely to be driven by renewable energy, electric vehicles, charging infrastructure, and the development of power transmission and distribution networks, Adani Enterprises said in a statement.

The Economic Times (29.03.2024)

FORM IV

*Statement about ownership and other particulars about newspaper (**IIM Metal News**) to be published in the first issue every year after the last day of February*

1. Place of publication : The Indian Institute of Metals, "Metal House", Plot 13/4, Block-AQ, Sector-V, Salt Lake, Kolkata - 700 091
2. Periodicity of its publication : Monthly
3. Printer's Name : Print Max
   Nationality : Indian
   Address : 44, Biplabi Pulindas Street, Kolkata - 700 009
4. Publisher's Name : Brig Arun Ganguli (Retd), Secretary General, IIM
   Nationality : Indian
   Address : The Indian Institute of Metals, "Metal House", Plot 13/4, Block-AQ, Sector-V, Salt Lake, Kolkata - 700 091
5. Editor's Name : Prof. K Bhanu Sankara Rao
   Nationality : Indian
   Address : The Indian Institute of Metals, "Metal House", Plot 13/4, Block-AQ, Sector-V, Salt Lake, Kolkata - 700 091
6. Names and addresses of individuals who own the newspaper and partners or shareholders holding More than one per cent of the total capital : Not Applicable

I, Brig Arun Ganguli (Retd), hereby declare that the particulars given above are true to the best of my knowledge and belief.

Date 28.03.2024

The Indian Institute of Metals

Signature of Publisher

Secretary General

****

Advertisers' Index	
Name of the Organisations	***Page Nos.***
Hindalco Industries Ltd	Cover
Tata Steel Ltd	2nd Cover
Steel Authority of India Ltd	13
Mishra Dhatu Nigam Limited	14
Instron	15
Star Testing Systems	27
M N Dastur & Company (P) Ltd	28
Chennai Metco Pvt Ltd	3rd Cover
JSW Steel Ltd	4th Cover

Chapter Activities — Kolkata, Bhubaneswar, Trivandrum

Kolkata Chapter

1) IIM Kolkata Chapter celebrated "Women's Day" on 8th March 2024 at JPC office Kolkata. EC Members and others Members of the Chapter were present in that occasion. Mr. Pankaj Dutta, Retd. IPS was the Chief Guest of the occasion. He delivered the inaugural lecture. Mr. S.K Basak, Chairman, IIM Kolkata Chapter described the need of Woman force in the progress of nation. Many dignitaries shared their thoughts on this topic. Prof. Tandra Mitra, Retd. Prof. of Jadavpur University was conferred with the 'Life Time Achievement Award' for her contribution in the field of Education. Mrs. Mita Sen has been awarded as Women Achiever in the professional field. Dr. Mahua Ghosh Chaudhury of Jadavpur University has been awarded with Women Achiever Award in the field of Education. More than 50 delegates were present in the occasion. Mr. P.K. Sen, former Chairman, IIM Kolkata Chapter modulated the entire function. The programme concluded with a Vote of Thanks by Mr. S.K. Dutta, Hony. Secretary, IIM Kolkata Chapter.

2) Metallix 2024 : On 15th and 16th March 2024, Jadavpur University, the Student Chapter of IIM Kolkata Chapter celebrated their flagship event 'Metallix 2024'. It was the 15th year of this event. This two days program was held in Triguna Sen auditorium in Jadavpur University. Students of different colleges and professionals of Metallurgical and Materials Engineering attended the program. Dr. Debasish Bhattacharyya, VP, Tata Steel was the Chief Guest of the occasion. Mr. S K Basak, Chairman, IIM Kolkata Chapter was present in the occasion. Many EC members of IIM Kolkata Chapter & Members were also graced the occasion with their presence.

Glimpse of "Women's Day" event

Bhubaneswar Chapter

1) The third EC meeting of IIM Bhubaneswar Chapter was held on 18th March 2024 in which the chapter activity for the month of April was discussed.

2) To commemorate the success of IIM-ATM 2023 conference and towards, the profit sharing of IIM-ATM 2023 conference: Rs. 20 lakhs by IIM HO to IIM Bhubaneswar chapter, a thanksgiving dinner was arranged on March 24, 2024 at Hotel Padmaja (Roof Top), Bhubaneswar. In this event, members of core organizing committee of IIM-ATM 2023 and IIM Bhubaneswar chapter's EC members have participated. Shri Bibhu Mishra, convenor of IIM-ATM (annual technical meeting) 2023 Committee and advisor of Hindalco Industries Ltd., handed over the cheque to IIM Bhubaneswar Chapter's Chairman Dr. AK. Chaubey and Secretary Dr. Ajit Panigrahi in presence of Shri SS Mohanty, Chairman IIM-ATM 2023, Dr. Ramanuj Narayan, Co-chairman of IIM-ATM 2023, Director, IMMT Bhubaneswar and Shri S. Samantaray, Co-chairman of IIM-ATM 2023, Director Commercial, Nalco. In this gathering, it was discussed that the money will be spend in organising seminars and symposiums for college and university students, research scholars and working technical professionals to promote metallurgy and explore innovations in the field of metal production.

Trivandrum Chapter

Prof. Brahm Prakash Memorial Lecture : IIM Trivandrum Chapter organized the 31st Prof. Brahm Prakash Memorial Lecture on 23rd March, 2024 at Hotel Forte Manor, Power House Jn, Trivandrum. The lecture was attended by 87 participants. The Chapter Chairman Dr. S.V.S. Narayana Murty delivered the welcome address. The chief guest was introduced by Dr. V. Anil Kumar, Hon. Secretary, IIM Trivandrum Chapter.

Shri R. Hutton, Project Director Gaganyaan, Human Spaceflight Centre, Indian Space Research Organization was the Chief Guest for the event. He delivered the talk 'Indian Human Space Mission-Challenges.' Subsequently he had interaction with Students and members of the Chapter.

Shri Hutton also gave away the Prizes to the winners of Brahm Prakash Memorial Quiz competition conducted by IIM Trivandrum Chapter. The vote of thanks was proposed by Dr. T.P.D. Rajan, Vice Chairman of the chapter. The meeting was followed by dinner.

A Glimpse of the audience

Shri. R.Hutton delivering the talk

Felicitation of Chief Guest

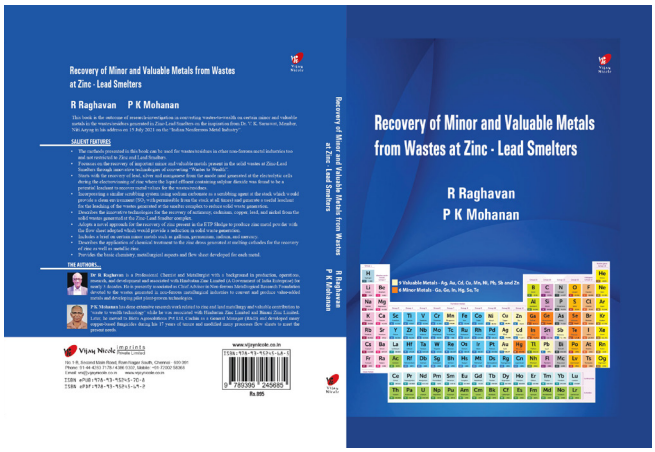
Prize distribution to Quiz Winners

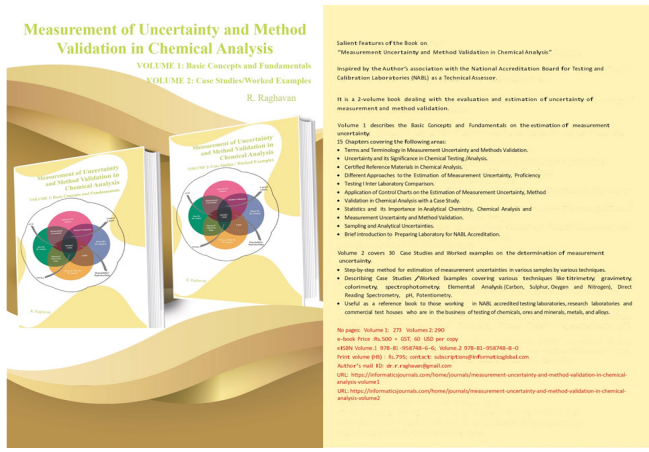
****

Member News — Dr R Raghavan

Dr. R. Raghavan, a Life Member of IIM, is a Professional Chemist and Metallurgist with a background in production, operations, research, and development and associated with Hindustan Zinc Limited (A Government of India Enterprise) for nearly 3 decades. He is presently associated as Chief Advisor in Non-ferrous Metallurgical Research Foundation devoted to the wastes generated in non-ferrous metallurgical industries to convert and produce value-added metals and developing pilot plant-proven technologies.

He has written 2 books "Recovery of Minor and Valuable Metals from Wastes at Zinc - Lead Smelters" and "Measurement of Uncertainty and Method Validation in Chemical Analysis (Vol 1 & 2)" which have been published recently.





****

Member News — Dr Sandip Ghosh Chowdhury

Dr. Sandip Ghosh Chowdhury has been appointed as the new Director of the CSIR- National Metallurgical Laboratory, Jamshedpur. Dr. Chowdhury is the Life Member of IIM since 2009.

He started his career in NML since 2000. He received Metallurgist of the year award from the Ministry of Steel, Govt. of India in 2015. He has 2 Books, 125 Journals and 20 Patents in his cap.

****

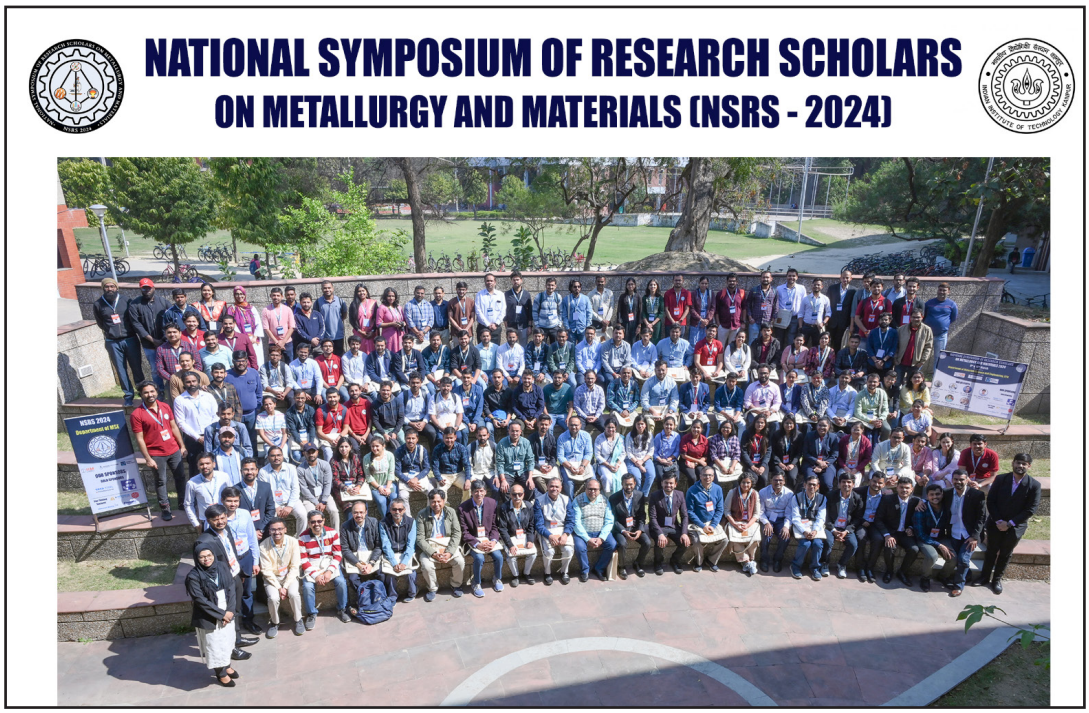
Seminars & Conferences — NSRS 2024

National Symposium of Research Scholars (NSRS-2024)

The National Symposium of Research Scholars on Metallurgy and Materials, held on March 9-10, 2024, was organised by the Department of Materials Science and Engineering at IIT Kanpur, in association with the Indian Institute of Metals-Kanpur Chapter, Material Advantage-Kanpur Chapter, and Materials Science Society-IIT Kanpur. The symposium aimed to serve as a platform for research scholars to showcase their work, exchange ideas, and foster collaborations in the field of materials science and metallurgy notably, the symposium stood out as it was organised by and for research scholars themselves. It operated under the supervision of national and local advisory committees, comprising experts from across the nation and faculty members from prestigious institutions. The symposium was steered by Dr. Niraj Chawake (Convener), Dr. Arunabh Meshram (Co-Convener), and Dr. Srinu Gangolu (Secretary), under the leadership of Prof. Kallol Mondal, the Head of MSE at IIT Kanpur.

The symposium drew a total of 145 participants, comprising 63 oral presentations, 55 poster presentations, and 27 entries in the Metallographic contest. Participants came from various esteemed institutions including IITs at Delhi, Gandhinagar, BHU, Patna, Jodhpur, Madras, Kharagpur, Bombay, Mandi, Indore, Kanpur, as well as from NITs at Calicut, Trichy, Allahabad, and from research institutions such as CSIR-NML Jamshedpur, IMMT Bhubaneswar, LIT Nagpur, DIAT Pune, IISER Thiruvananthapuram, IISER Berhampur, IIEST Shibpur, HRI Allahabad, and universities like SRM and Sharda University.

- The Key Highlights of NSRS-2024:
  - Distinguished plenary talks were delivered by Professor Rajesh Prasad (IIT Delhi), Professor K C Hari Kumar (IIT Madras), Professor Sanjay Mittal (IIT Kanpur), and Professor Monica Katiyar (IIT Kanpur).
  - Dr. Suresh Kumar, Scientist G from DMSRDE Kanpur, delivered a well-received talk during the event.
  - Panel discussions led by Professor Kantesh Balani and Professor Shivam Tripathi centered around pertinent topics such as work-life balance and opportunities for research scholars.
  - The symposium was graced by Professor Tarun Gupta (Dean Research and Development, IIT Kanpur), as the inaugural guest, while the valedictory guests were Professor Rajeev Shekhar (MSE, IIT Kanpur) and Professor Sandeep Sangal (MSE, IIT Kanpur).



- Technical Program:

  The technical program encompassed oral and poster presentations covering a wide array of topics such as Energy Materials, Functional Materials, Process Metallurgy, Recycling of Materials and Sustainability, Mechanical Behaviour of Materials, Corrosion Engineering, and Computational Materials Science Additionally, a metallography contest was also conducted.

  ❑ A comprehensive abstract book has been published, featuring detailed information on the technical talks and the complete technical program of the symposium. One can access the abstract book via the following link: https://drive.google.com/file/d/1UKvygk9OPR0sCr5ft5ZZm1Sbtznz732r/view.

For further information about the symposium, including additional details, please visit the NSRS-2024 website at the following link: https://sites.google.com/view/nsrs-2024/home?authuser=0.

****

Seminars & Conferences | ICNFM MS-2024

International Conference on "Nonferrous Metals & Material Science 2024"

IIM Kolkata Chapter organised an International Conference on "Nonferrous Metals & Material Science 2024" on March 29th & 30th, 2024 at Biswa Bangla Convention Center, Kolkata.

The program was inaugurated with the Welcome address of Mr. Satish Pai, President of The Indian Institute of Metals which was followed by the lamp lighting ceremony. After that, Mr. S K Basak, Chairman, IIM Kolkata Chapter welcomed the delegates in his welcome speech. Mr. Sanjib Kumar Singh, Director Mining, HCL was the Chief Guest in this Inaugural Session. Mr. Dipak Chattaraj, CEO, SAIL Rourkela Steel Plant delivered the Key note address. Prof. Santanu Das, Professor & Former HOD of Mechanical Engineering, Kalyani Govt. Engineering College & Chairman, IIW – Kolkata Center, Prof. S Chatterjee, Former Dean & Prof. Dept. of Metallurgical Engg., IIEST & Dr. Debasish De Sarkar, CEO, ICDC & Co-Chairman of the event took part in a Panel Discussion. Brig Arun Ganguly(Retd), Secretary General, IIM was present on the occasion. All the speakers were felicitated with flowers and mementoes.

On the first day of the event, there were three Technical Sessions. Many Academicians, Industrials Experts presented their presentation on the relevant topic.

On the second day of the first session the Chief Guest was Prof. Amitava Dutta, Pro. Vice-Chancellor, Jadavpur University. Dr. Ramanuj Narayan- Director, CSIR, Institute of Minerals & Materials Technology, Bhubneswar, Dr. Debashish Bhattacharjee, VP, Technology and R&D, Tata Steel Ltd. also graced the occasion. Dr. Debashish Bhattacharjee was felicitated with 'Life Time Achievement Award" for his contribution in the Industry and Prof. Amitava Dutta, was also felicitated. After that, one illuminating technical Session started and the speakers from industries and academia were felicitated after their speech. The program ended with a vote of thanks by Shri S K Dutta, Secretary, IIM Kolkata Chapter. About 150 delegates, invitees and IIM Members attended the event.

****

International conference on

Science, Technology and Applications of Rare Earths

ICSTAR 2024

August 21-23, 2024

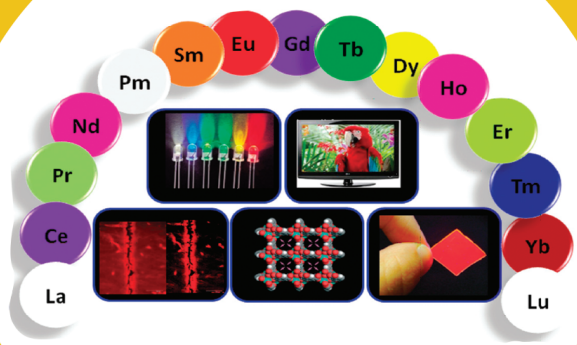
Organized jointly by

Rare Earth Association of India

&

The Indian Institute of Metals

Trivandrum Chapter



Venue:

Uday Samudra

Kovalam
Thiruvananthapuram
India

First Circular and Call for papers

www.icstar2024.com

E-mail: icstar2024@gmail.com

Important Dates

Abstract submission closes on: 15th May, 2024

Acceptance of abstracts: 1st June, 2024

Early-bird registration ends on: 15th July, 2024

Payment Options

Foreign Delegates - Wire Transfer

Payment should be made through wire transfer by using the following details

Account Name : **Rare Earth Association of India (REAI)**
Account No : **67146367193**
Bank Name : **State Bank of India**
Branch name : **Industrial Estate, Pappanamcode**
IFSC Code : **SBIN0070030**
MICR : **695002943**

Note: Participants must bear the fees their banks charge for the remittances out of their accounts.

Registration Fee

Registration fee will enable to entitle for entry to conference sessions, exhibitions, tea/coffee breaks, conference lunch, dinner, conference kit and abstract book. In addition to the scientific activities of the conference, site seeing tours may be arranged upon request. For more details, please contact the information/travel desk at the conference venue.

Details	Indian	Foreign
Delegate fee	Rs 6,000/-	USD 400/-
(REAI Members & IIM Members)	Rs. 4,500/-	
Retired Members (REAI & IIM)	Rs. 3,500/-	
Students - (REAI Non-Members) (REAL Members)	Rs. 3,000/- Rs. 2000/-	USD 200/-
Accompanying Person (India)*	Rs. 5,000/-	USD 150/-

* Registration kit is not included for accompanying person.

The Indian Institute of Metals' Head Office and Short Professional Educational Courses Committee

In association with IIT Kharagpur Faculties shall conduct a course on

"Material Failure Analysis- Basics & Practices"

(Course Number IIM-24-104)

27th to 29th May, 2024, 9:00 hrs to 13:00 hrs

Background: Components used in services fail at certain point of service and sometimes it is a premature failure. It becomes important to understand whether a component failed as per design or due to unforeseen extraneous reasons. It is essential to understand the root causes that violated the design parameter of the materials. Failure analysis are liability intensive in some industry and immediate resolution to overcome the causative factors are important. Failure analysis validates the specification or enables improvement of the same. Timely resolution of failures in production components enables faster restoration of the line function. Failure analysis also enables redesign and new product development. The overall losses to the institution are minimized, when failures are quickly resolved and the costs associated with material, processes and quality inspection are saved. An effective failure analysis also plays a major role in preventing future catastrophes repeating, thereby saving both human lives and avoiding huge financial losses. Ultimately, the customer gets a standard assured product that improves the reliability of the component in service. In this regard, there is a demand form industry to conduct this course on failure analysis.

Speaker Profile: The faculty of the course consists of the following professors of eminence from IIT, Kharagpur:

1. Prof. Rahul Mitra
2. Prof. Debalay Chakrabarti
3. Prof. Sumantra Mandal
4. Prof. Indrani Sen
5. Prof. Siddhartha Roy
6. Industrial Expert, Dr M Sathya Prasad

The course content would be covered in online mode through electronic media. All registering candidates will get a participation certificate and performance certificate.

Who should attend: The course is useful for practising industry professionals in automotive, steel and aerospace sectors, nuclear and thermal power plants, as well as research and academic professionals, students, and materials scientists from private and Government R&D laboratories. It will help people to be educated in methodology for analysing the nature of failure and its root cause in engineering components during processing or on loading under different conditions.

Course Content:

Lecture	Title	Lecture	Title
1.	Failure Analysis of Metallic Systems- Why and How (IS)	7.	Non-destructive testing as a valuable tool for failure analysis in the industry (SR)
2.	The importance of understanding the industrial processing defects to perform failure analysis of engineering components (DC)	8.	Analysis of failures in engineering components exposed to static and dynamic loading at high temperature (RM)
3.	Environment assisted materials degradation: case studies and associated failure analysis (SM)	9.	Basics of fatigue and methods to improve component life

Registration Fees and Payment Methods

Participant type	Online Course for 3 days.
IIM Members	5000 + 900* = 5900
IIM Non Member	7500 + 1350* = 8850
Student Member	1000 + 180* = 1180
Student Non-member	1500 + 270* = 1770
*(18% GST)	

Participants may join for the 3 days course module which shall be conducted virtually,

Procedures

- Advance payment of Registration fees is mandatory.
- Organizations may write to Administrative Co-ordinator for issuance of GST Invoice for making the Payments
- Participation fee is non-refundable; however, change in nomination is possible
- Students may furnish suitable proof of their student status on email to Administrative Coordinator while filling the online form
- 10% discount shall be offered for registering more than 5 persons from an Organization.
- Organizational/ Individual Participants are requested to register via https://shorturl.at/yQUV5 and pay online as per the details below.

Led by :

Dr G Balachandran
Chairman, SPECS Committee,
The Indian Institute of Metals
iimshortonlinecourses@gmail.com

Administrative Co-ordinator
Ms. Atashi Saha
Addl General Manager
The Indian Institute of Metals
atashi.sahaiiom@gmail.com
/iimshortonlinecourses@gmail.com

Bank Details
A/c name:
The Indian Institute of Metals
Bank: State Bank of India,
SME Branch, Salt Lake,
Branch Code: 04289,
IFSC Code: SBIN0004289
Current A/c No.: 54015600024
GST: 19AAATT3359D1ZF
PAN: AAATT3359D

Iron & Steel Statistics — World

Crude Steel production by region

	Feb 2024 (Mt)	% change Feb 24/23	Jan-Feb 2024 (Mt)	% change Jan-Feb 24/23
Africa	1.8	8.1	3.7	12.3
Asia and Oceania	109.7	3.9	227.1	2.7
EU (27)	10.6	-3.3	21.1	-0.9
Europe, Other	3.7	32.5	7.6	27.2
Middle East	4.2	10.8	8.9	17.0
North America	8.7	-1.3	17.7	-2.2
Russia & other CIS + Ukraine	6.7	-2.5	13.7	-0.7
South America	3.5	10.5	7.1	4.8
Total 71 countries	**148.8**	**3.7**	**306.9**	**3.0**

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

	Feb 2024 (Mt)	% change Feb 24/23	Jan-Feb 2024 (Mt)	% change Jan-Feb 24/23
China	81.2 e	3.5	168.0	1.6
India	11.8	11.4	24.5	10.0
Japan	7.0	1.1	14.3	0.8
United States	6.5	-1.2	13.0	-2.6
Russia	5.7 e	-4.4	11.7	-3.2
South Korea	5.1	-1.5	10.8	0.2
Türkiye	3.1	46.6	6.3	34.5
Germany	3.1	4.4	6.2	4.6
Brazil	2.8	13.1	5.5	6.4
Iran	2.2	14.3	4.8	26.5

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

Source : worldsteel.org

Non-Ferrous Metals Statistics Domestic Scenario

Production (unit : Lakh Tonnes)

	Feb'24	Jan'24	Dec'23	2022 - 23	2021 - 22
ALUMINIUM					
NALCO	0.37	0.40	0.40	4.60	4.60
HINDALCO*	1.06	1.13	1.12	13.22	12.94
BALCO	0.46	0.49	0.49	5.69	5.80
VEDANTA LTD	1.44	1.53	1.52	17.22	16.92
TOTAL	**3.33**	**3.55**	**3.53**	**40.73**	**40.26**
*Renukoot, Hirakund, Mahan, Aditya					
ZINC (One major producer)					
HZL	**0.72**	**0.70**	**0.70**	**8.21**	**7.76**
COPPER (Cathode)					
HCL	0	0	0	0.000073	0.62
HINDALCO	0.34	0.37	0.36	4.07	3.59
SSL	0.11	0.13	0.16	1.48	1.25
TOTAL	**0.45**	**0.50**	**0.52**	**5.55**	**4.85**
LEAD					
HZL	**0.17**	**0.17**	**0.16**	**2.11**	**1.91**

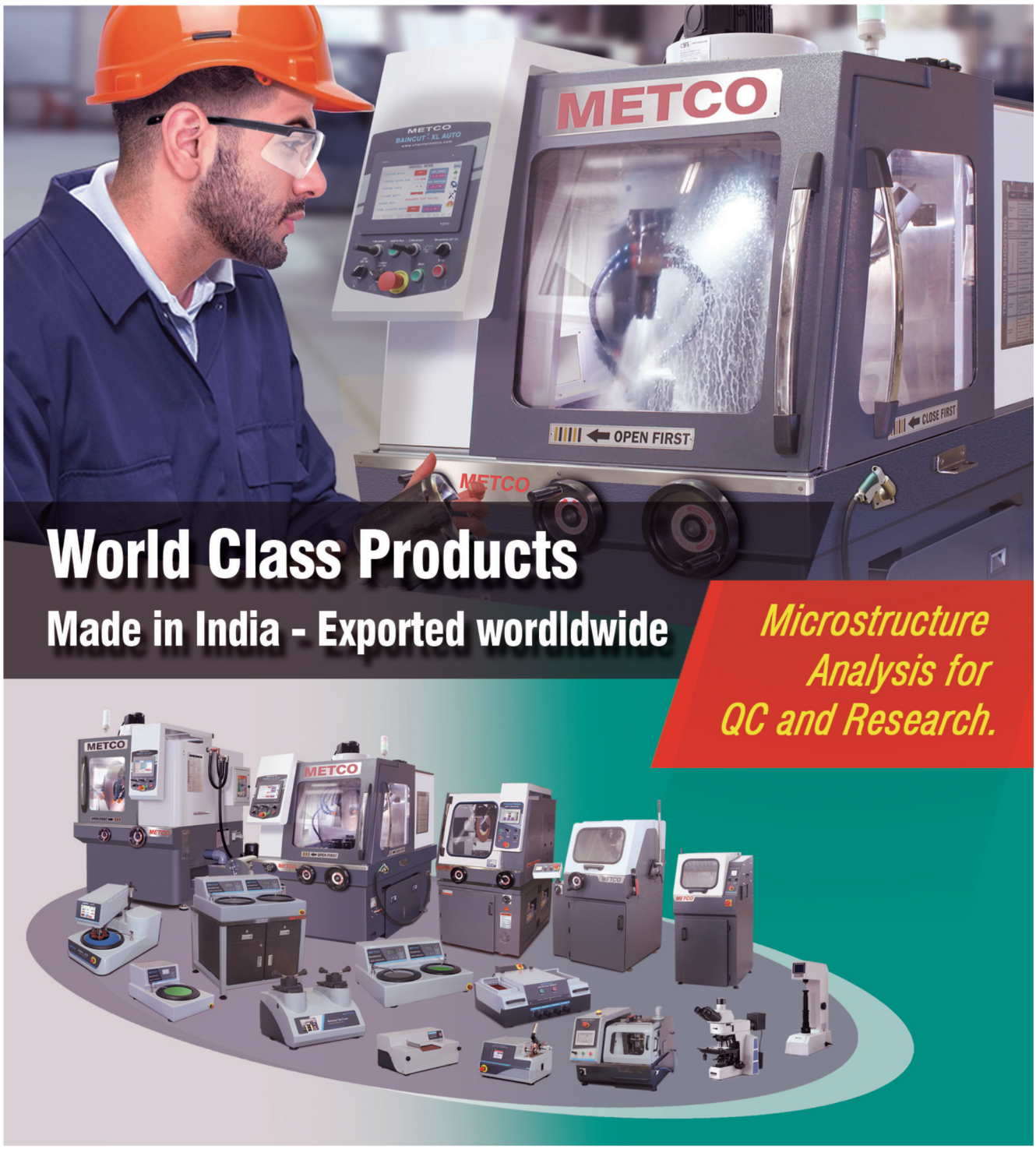
Source : https://mines.gov.in/

Prices in India (as on 29th March, 2024)

(Mumbai Local Price in Rs. / kg)

Product	Rs. / kg	Product	Rs. / kg
Copper Armature	738	Aluminium Ingot	214
Copper Cathod	789	Aluminium utensil	175
CC Rod	790	Zinc Ingot	220
Copper Cable scrap	753	Lead ingot	185
Brass Sheet Scrap	530	Tin Ingot	2482
Brass Honey Scrap	508	Nickel Cathod	1428

Source : http://www.mtlexs.com/



Chennai Metco

www.chennaimetco.com