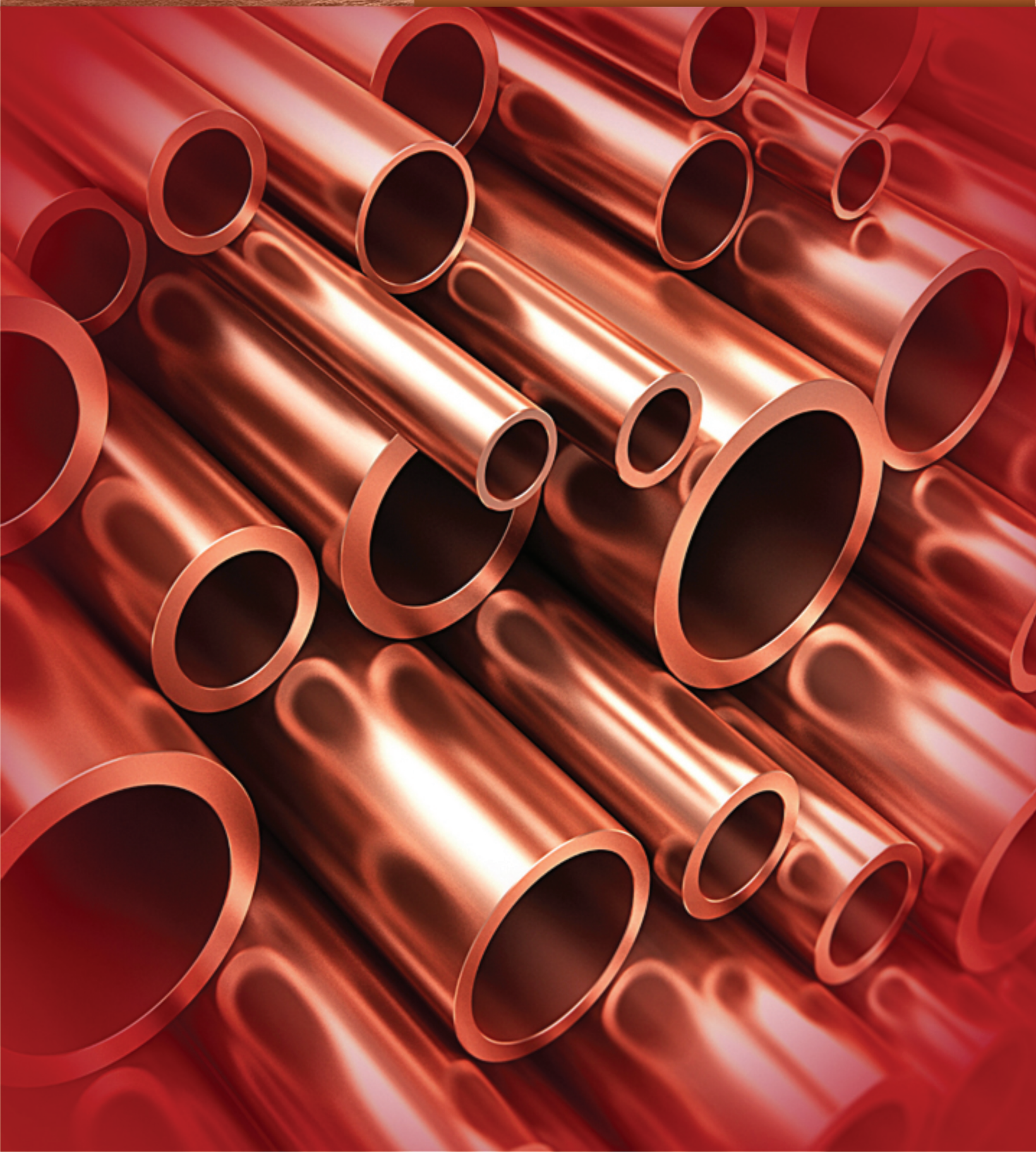
ISSN 0972-0480 • Vol. 26 No. 2 • February 2023

IIM METAL NEWS

A monthly publication of The Indian Institute of Metals



Non-Ferrous Metals Statistics Domestic Scenario

Production (unit : Lakh Tonnes)

	Nov'22	Oct'22	Sep'22	2021 - 22	2020 - 21
ALUMINIUM					
National Aluminium Co Ltd	**0.37**	**0.38**	**0.37**	**4.60**	**4.18**
Hindalco Industries Ltd*	**1.09**	**1.13**	**1.09**	**12.94**	**12.28**
Bharat Aluminium Co. Ltd	**0.46**	**0.47**	**0.46**	**5.80**	**5.68**
Vedanta Ltd	**1.39**	**1.43**	**1.42**	**16.78**	**13.72**
TOTAL	**3.31**	**3.41**	**3.34**	**40.12**	**35.86**
*Renukoot, Hirakund, Mahan, Aditya					
ZINC (One major producer)					
Hindustan Zinc Ltd	**0.73**	**0.70**	**0.63**	**7.76**	**7.15**
COPPER (Cathode)					
Hindustan Copper Ltd	**0**	**0**	**0**	**0.62**	**Nil**
Hindalco (Birla Copper)	**0.35**	**0.34**	**0.35**	**3.95**	**2.89**
Vedanta Ltd.	**0.09**	**0.11**	**0.13**	**1.37**	**1.118**
TOTAL	**0.44**	**0.45**	**0.48**	**5.94**	**4.008**
LEAD					
Hindustan Zinc Ltd	**0.16**	**0.16**	**0.16**	**1.91**	**2.14**

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

Prices in India (as on 21st January, 2023)

(Mumbai Local Price in Rs. / kg)

Product	Rs. / kg	Product	Rs. / kg
Copper Armature	**718**	Brass Honey scrap	**485**
Copper cathod LME ++	**806**	Brass Shell 40mm	**613**
CC Rod LME ++	**823**	Aluminium Ingot	**229**
Copper Cable scrap	**746**	Aluminium utensil scrap	**168**
Copper shell 40mm	**768**	Zinc Slab	**300**
Electrolytic Copper strip 25mm	**768**	Lead ingot	**198**
ACR Copper Coil 3/8	**828**	Tin Slab	**2425**
Brass Sheet scrap	**527**	Nickel Cathod	**2400**

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

IIM METAL NEWS

Vol. 26 No. 2 February 2023

Chief Editor
Dr. N Eswara Prasad

Printed and Published by
Shri Kushal Saha, Secretary General IIM,
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


@ICSP 2023

THE INDIAN INSTITUTE OF METALS

PATRONS

Mr R M Dastur — Dr Baba Kalyani

ADVISORY COMMITTEE OF FORMER PRESIDENTS

Mr M Narayana Rao, Mr H M Nerurkar, Prof K Chattopadhyay, Dr R N Patra, Mr S S Mohanty, Prof Indranil Manna, Dr Samir V Kamat, Convenor, Dr Biswajit Basu, Mr Anand Sen, Dr U Kamachi Mudali

COUNCIL FOR THE YEAR 2022-23

PRESIDENT
Dr Samir V Kamat

VICE PRESIDENT & CHAIRMAN
Non- Ferrous Division
Mr Satish Pai

VICE PRESIDENT & CHAIRMAN
Ferrous Division
Mr Sajjan Jindal

VICE PRESIDENT & CHAIRMAN
Metal Science Division
Prof B S Murty

IMMEDIATE FORMER PRESIDENT
Mr T V Narendran

SECRETARY GENERAL
Mr Kushal Saha

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
Dr N Eswara Prasad

Jt. SECRETARY
(Office of President)
Dr R Balamuralikrishnan

MEMBERS

Mr Arun Kumar Agrawal
Dr Murugaiyan Amirthalingam
Prof Amit Arora
Dr Nagamani Jaya Balila
Dr Suddhasatwa Basu
Dr Amit Bhattacharjee
Dr Debashish Bhattacharjee
Mr Atanu Bhowmick
Mr P Chakraborty
Dr Indranil Chattoraj
Dr Vikas Chaudhari
Dr D DeSarkar
Prof Manojit Ghosh
Mr Prabhash Gokarn
Mr Praveen Jain
Dr S K Jha
Dr Vikas Jindal
Dr J Krishnamoorthi
Mr Anjani Kumar
Dr Mukesh Kumar
Dr Atish Mandal
Prof B K Mishra
Mr Bibhu Prasad Mishra
Dr Suman Kumari Mishra
Prof Sushil K Mishra
Mr Arun Misra
Prof Rahul Mitra
Dr D P Mondal
Ms Soma Mondal
Mr K Nagarajan
Mr Dilip Oommen
Mr Ambika Prasad Panda
Mr Gajraj Singh Rathore
Dr Asim K Ray
Dr G Madhusudhan Reddy
Mr Barun Roy
Mr Bhaskar Roy
Mr Sanjay Sharma
Mr Vidya Ratan Sharma
Mr Arun Kumar Shukla
Mr A K Singh
Prof Amarendra Kumar Singh
Dr Bimal P Singh
Mr Brijendra Pratap Singh
Mr Deependra Singh
Mr Lokendra Raj Singh
Prof Sudhansu Sekhar Singh
Dr Dheepa Srinivasan
Prof Satyam Suwas
Dr Vilas Tathavadkar
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	Dr 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

FORMER SECRETARIES / SECRETARY GENERALS*

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

Technical Article

Failure of Welded Lug Assembly of Body Structure of a Helicopter

Vedula Ram Prasad, Vaisakhi Nandi and Ashish Misra

Abstract

Lug-assembly belonging to the body structure of a military helicopter was found cracked at Mixing unit attachment point. This is a critical part as it attaches the mixing unit of flight control system to the main helicopter body. Lug-assembly consists of a lug welded to a clamp; the clamp is in-turn welded to the tubular frame of the helicopter body. At about 2800 flying hours, crack was detected in the lug along the weld joint between lug and clamp. The lug was made of Cr-Mo-V steel (equivalent to French specification 15CDV6) and was in hardened and tempered condition.

Laboratory analysis showed that the material of construction (MOC) of the cracked lug had met specified requirements with respect to its chemistry, hardness and microstructure. Fractographic studies (Scanning Electron Microscopy) revealed that the lug had a fatigue failure, which had originated at multiple locations from the weld joint between the lug and the clamp. Further, the location of failure origins corresponded to a portion of weld joint wherein the clamp material did not fuse with the lug while welding. In addition to lack of fusion, numerous weld porosities (micro-porosities) were also observed at the failure origins. Lack of fusion was evident in lug-to-clamp weld joint while assessing the weld quality through macro/ micro examination of the weld cross-section. Systematic metallurgical investigation carried out to arrive at the cause of failure is described in the present paper. Also, remedial measures regarding the welding process, quality and inspection as well as on the design of lug-assembly at mixing unit attachment point are discussed.

Keywords : Helicopter body structure, mixing unit, welded lug assembly, lack of fusion, weld porosities, fatigue striations.

1. Introduction and Background Information

A helicopter has primarily three flight control inputs namely the cyclic stick, collective stick and tail rotor or anti-torque pedals. The main purpose of flight controls in helicopter is to change the pitch angles of the main and tail rotor blades and enable the pilot to control helicopter elevation, speed and direction. The main rotor controls comprise of Collective, Cyclic Longitudinal (Pitch) and Cyclic Lateral (Roll) channels, which together control the main rotor blade pitch angles. Mixing of collective and cyclic inputs is done at the mixing unit. Main rotor mixing unit ensures that all the control inputs are transmitted to the main rotor without loss of input or one influencing the other [1-3].

In one type of military helicopter flying at high altitudes in mountainous regions, failure was reported in the part lug-assembly that attaches the main rotor mixing unit to the helicopter body structure. The mixing unit is attached through fasteners to the lug-assembly. Lug-assembly consists of a lug that is welded to a clamp. The clamp is in-turn welded to tubular frame of the helicopter body. Fig.1 shows the photograph of the location of failure/crack in the lug-assembly on the helicopter before disassembly or removal. The crack was detected at about 2800 flying hours.

Central Materials and Processes Laboratory, Foundry and Forge Division
Hindustan Aeronautics Limited (HAL), Bangalore-560017, India
Email: ***cmpl.fnf@hal-india.co.in***

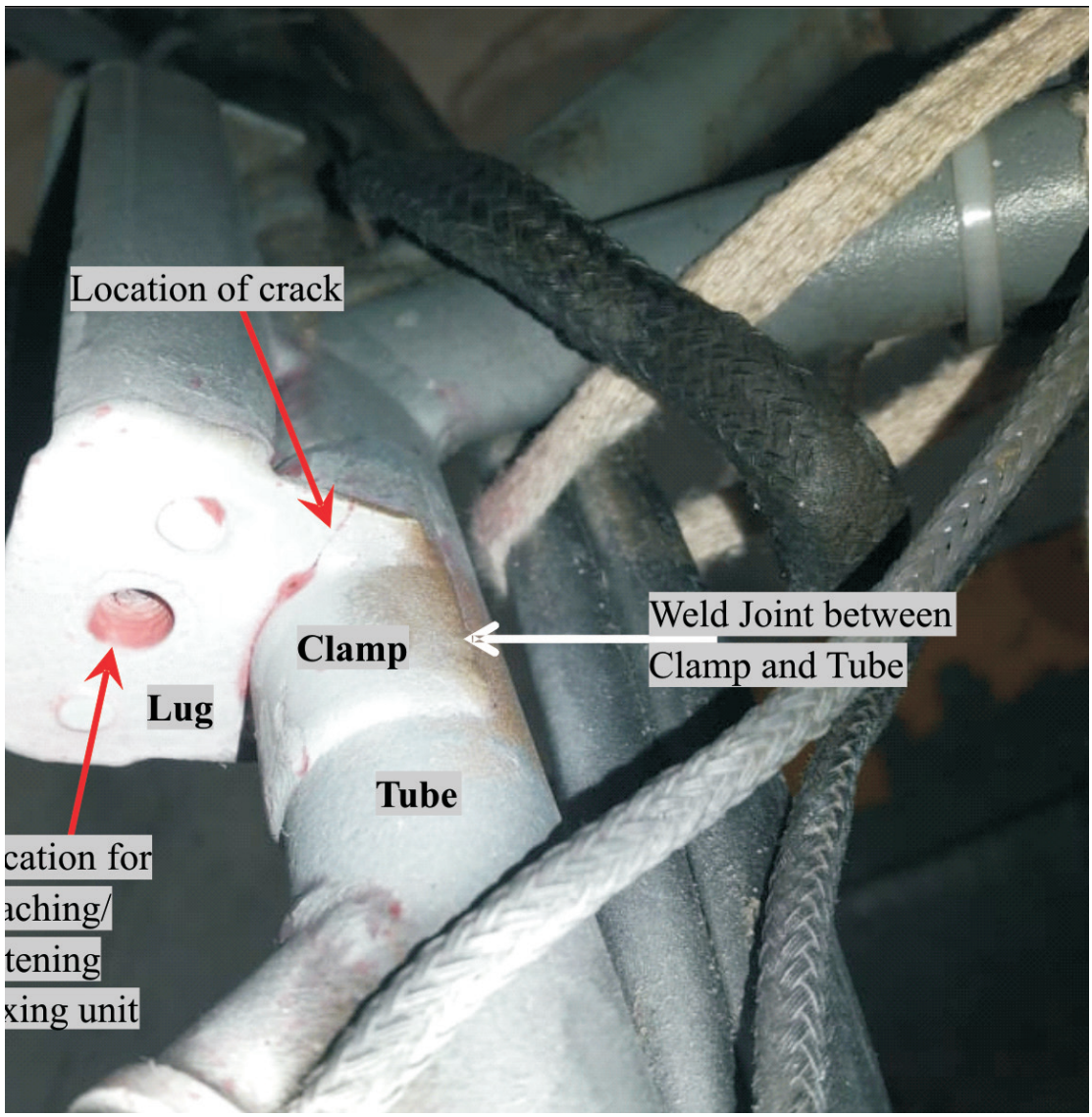


Fig.1: Cracked lug-assembly showing 'lug' & 'clamp' (welded to a tube).

Both lug and clamp of lug-assembly were made respectively from 2 mm and 1.5 mm thick sheets of Cr-Mo-V steel of 15CDV6 material specification and were hardened and tempered.

For detailed investigation, failed lug-assembly was dismantled/ removed from the helicopter by cutting along the clamp-to-tube weld joint. Photographs showing different views of the lug-assembly are given in Fig. 2a & 2b. The outer and inner surfaces of the lug and the weld joint between lug and clamp are indicated in Fig.2a. A major crack was observed in the lug-to-clamp weld joint (Fig.2b) and a detailed metallurgical analysis carried out to arrive at the cause of failure and a few suggested remedial measures are described in the present paper.

2. Observations

Figure 2c shows the extent of crack in the lug-assembly as revealed in Fluorescent Penetrant Inspection (FPI). The crack was located towards the lug-side of the weldment. Apart from the said crack, radiography (X-ray inspection) did not show any other significant weld defects in the assembly.

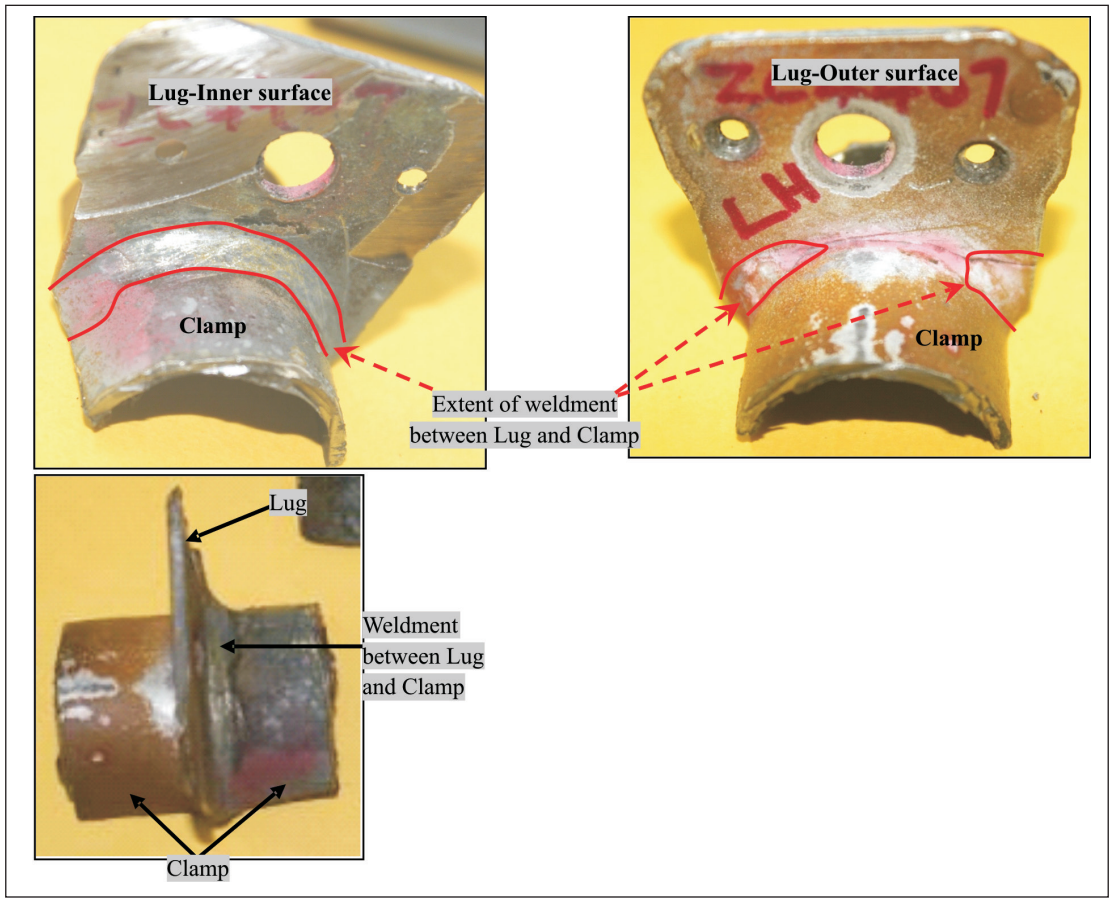


Fig.2a: Different views of the lug assembly after dismantling it from the helicopter. Extent of weldment between the parts lug and clamp is indicated

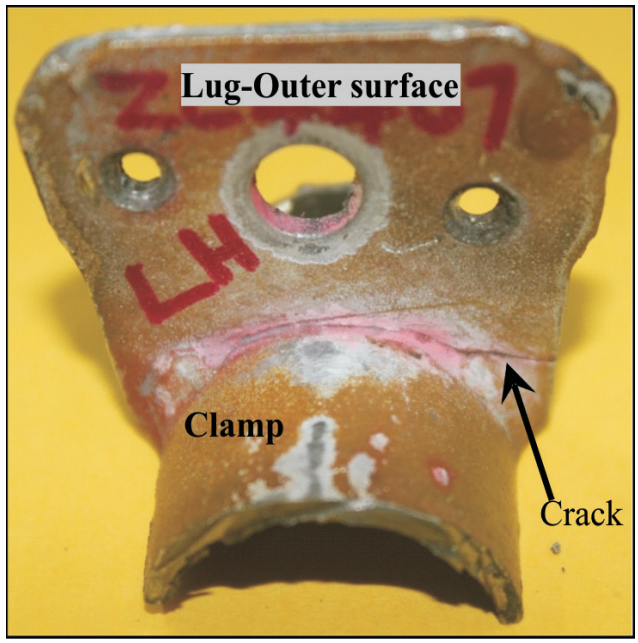


Fig.2b: Crack as seen in the lug-clamp weldment

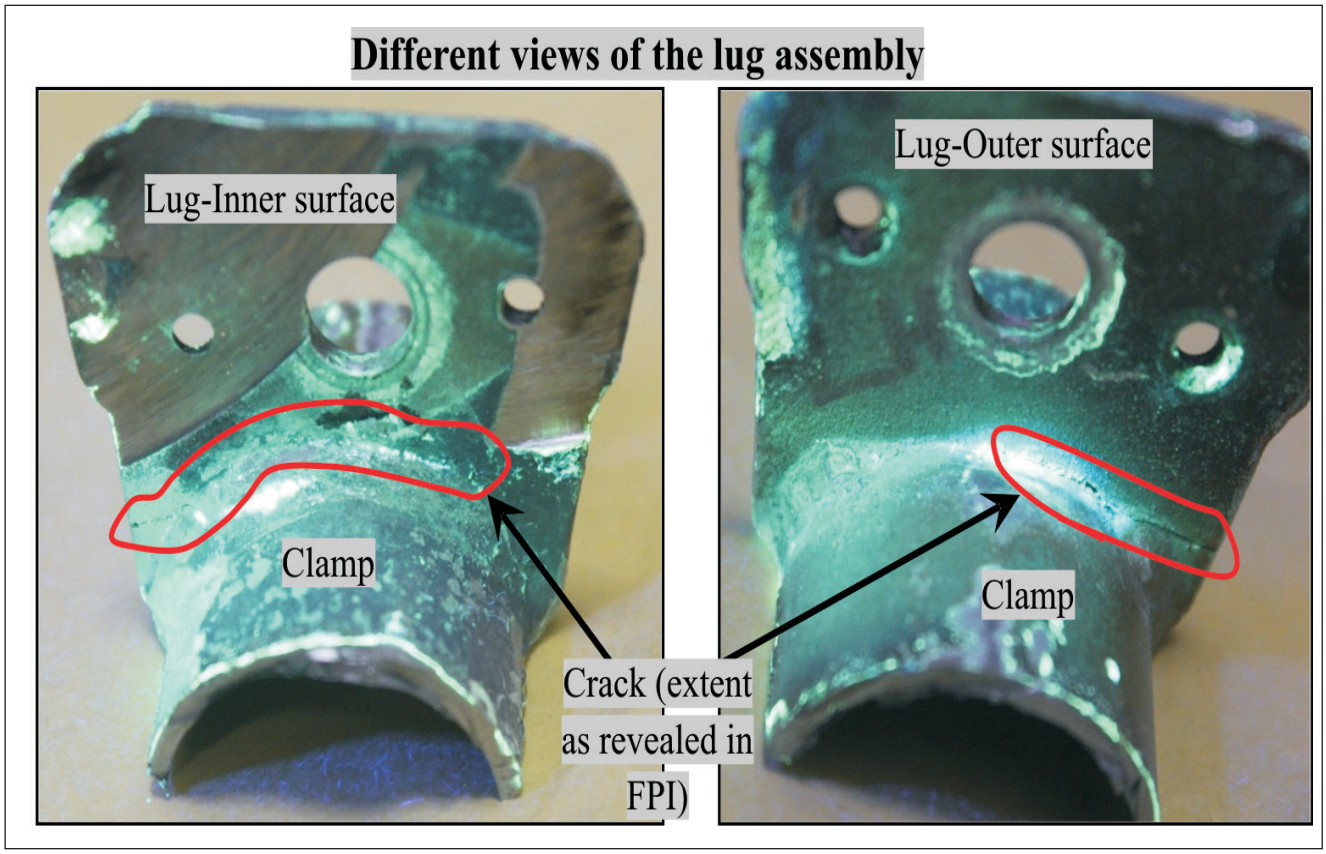


Fig.2c: Extent of crack in the lug-assembly as revealed in FPI

2.1. Material Analysis

Crack was observed in the lug alongside the lug-to-clamp weldment. The lug was checked for its material properties e.g. chemistry, hardness and microstructure. Chemistry of the lug was examined by spectrometric technique. Its chemical composition conformed to the 15CDV6 specification requirements; the hardness and microstructure of the lug also met the requirements specified in the component drawing. Results of material analysis of the lug are given in Table 1.

Table 1: Material analysis of the lug

	Element (Weight%)									Specification	Avg. Hardness	Micro structure
	C	Mn	Si	S	P	Cr	Mo	V	Fe			
Observed	0.14	0.9	0.2	0.002	0.008	1.35	0.8	0.26	Bal.	15CDV6	358 HV0.5	Hardened and Tempered (Tempered martensitic) structure
Requirements	0.12-0.18	0.8-1.1	0.2 max.	0.015 max.	0.020 max.	1.25-1.5	0.8-1.0	0.2-0.3	Bal.	15CDV6	≥29 HRC (~294 HV min.)	Hardened and Tempered

2.2. Fractographic studies

Crack (indicated in Fig. 2b and 2c) in lug-assembly was opened up for fractographic studies. Resultant mating fracture surfaces obtained after opening of crack are shown in Fig.3a. The fracture surface was examined under SEM to analyze the mode/ type and initiation of failure.

Low magnification SEM image of the fracture surface of lug-assembly is given in Fig.3b. High magnification SEM analysis revealed presence of very fine and not well-defined striations on the fracture surface. Representative high magnification SEM images showing fine fatigue striations on the fracture surface are given in Fig.3c; presence of striations is a typical feature of fatigue failure.

In fractography, lug-to-clamp weldment showed a portion wherein the clamp material did not fuse while welding. This unfused portion of the clamp is indicated in the digital photograph and SEM image in Fig.3b. From gross fractographic features and orientation of fatigue striations, it appeared that the fatigue failure had initiated at multiple locations from this unfused portion of the clamp. Initiation and propagation of fatigue failure is indicated by dotted arrow marks in the SEM images in Fig.3d. In addition to lack of fusion, numerous weld porosities (micro-porosities) were also observed at the failure origins (Fig.3d).

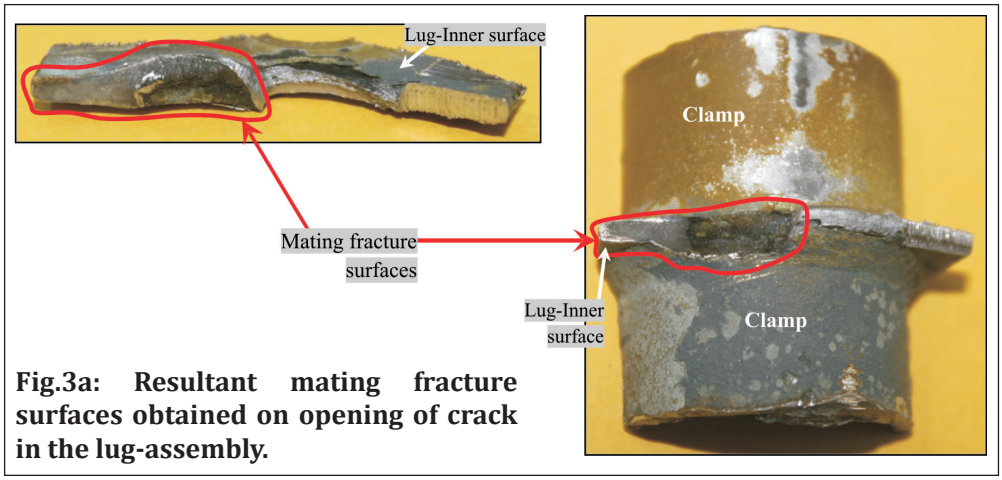


Fig.3a: Resultant mating fracture surfaces obtained on opening of crack in the lug-assembly.

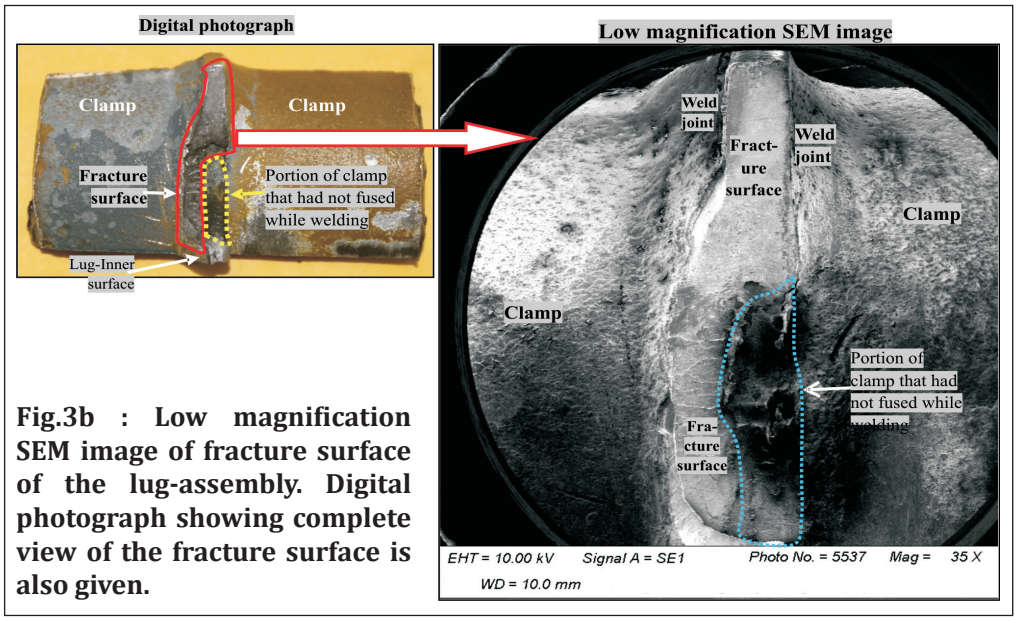


Fig.3b : Low magnification SEM image of fracture surface of the lug-assembly. Digital photograph showing complete view of the fracture surface is also given.

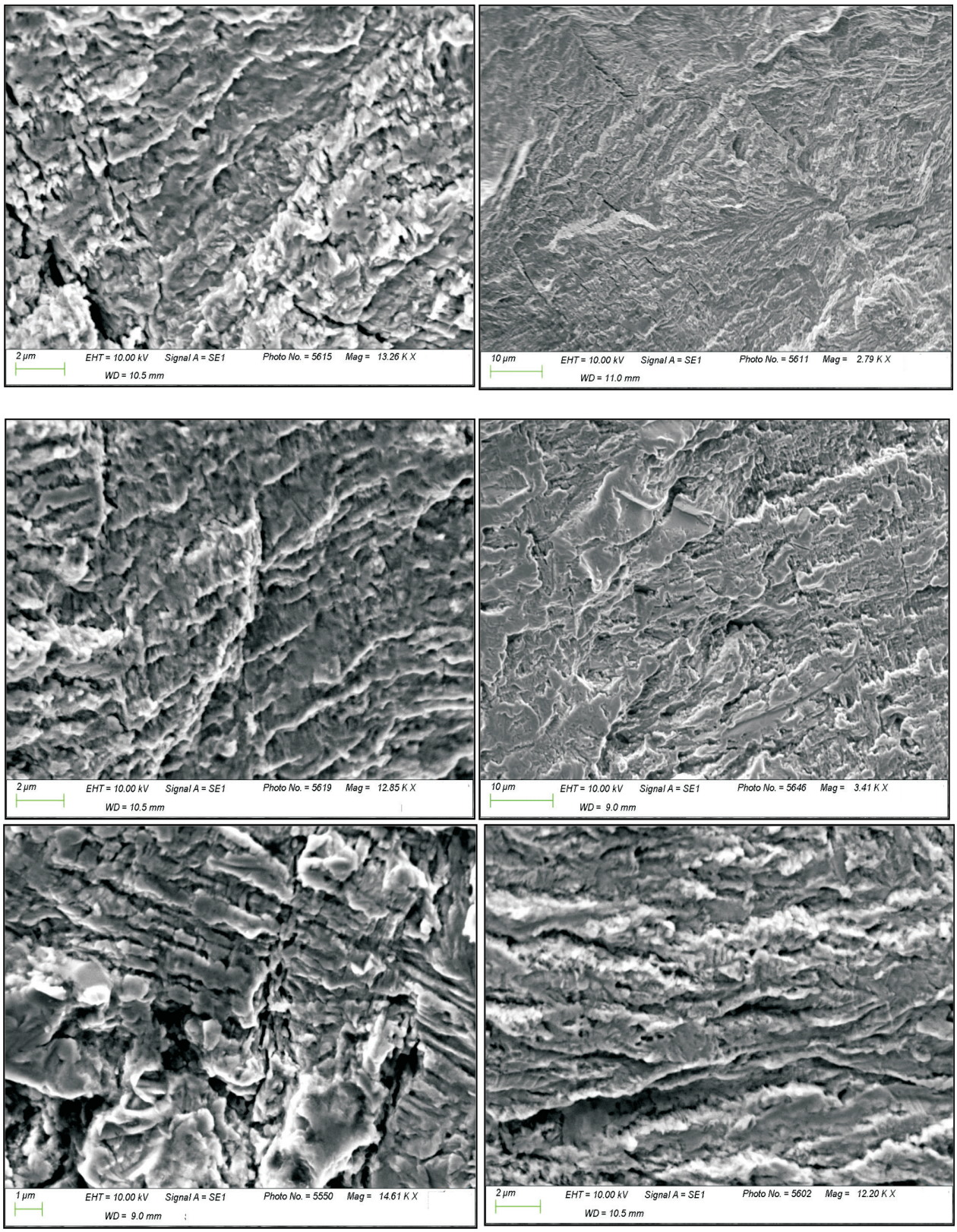


Fig.3c : Representative high magnification SEM images showing very fine fatigue striations on fracture surface of the lug-assembly

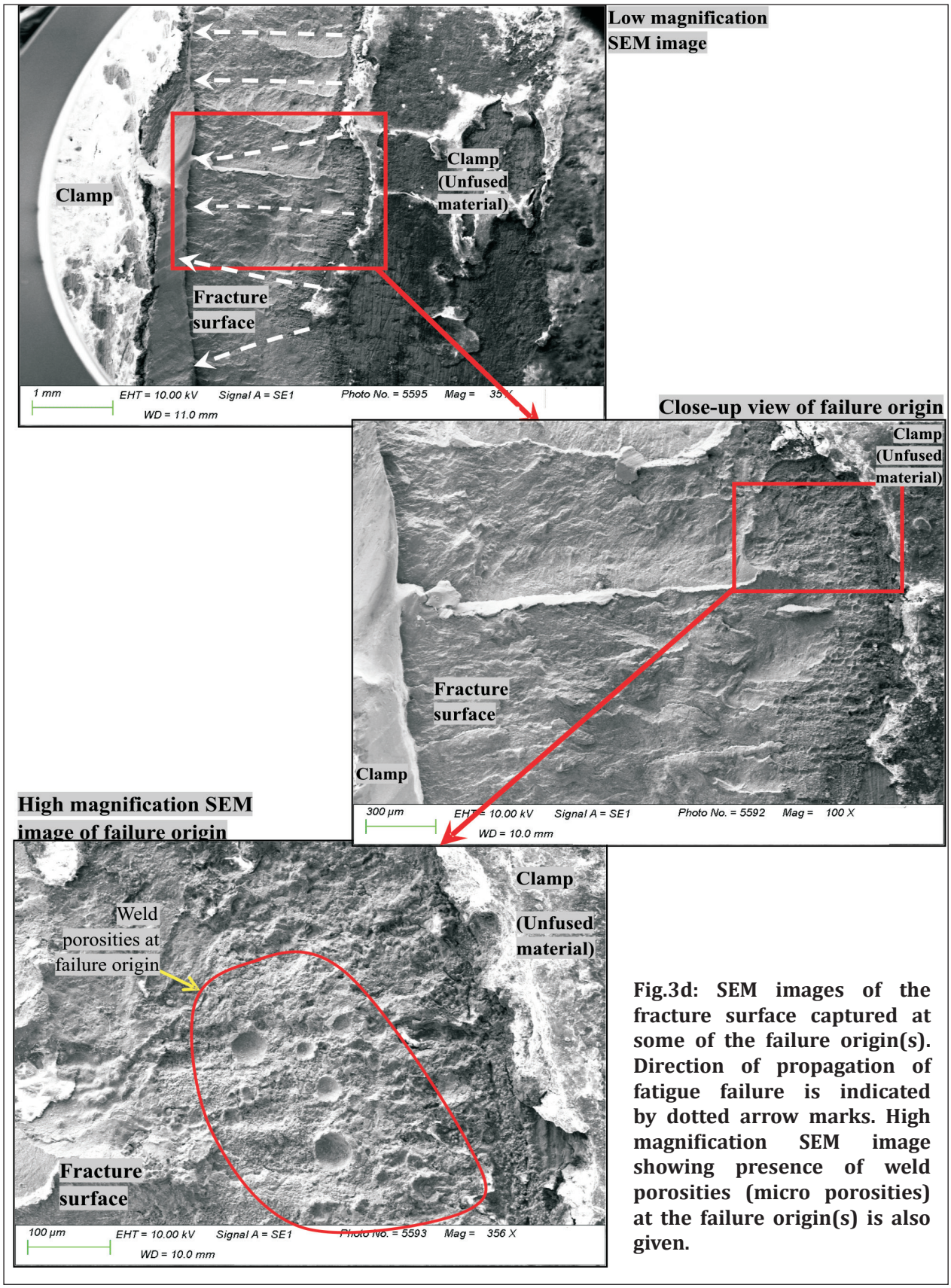


Fig.3d: SEM images of the fracture surface captured at some of the failure origin(s). Direction of propagation of fatigue failure is indicated by dotted arrow marks. High magnification SEM image showing presence of weld porosities (micro porosities) at the failure origin(s) is also given.

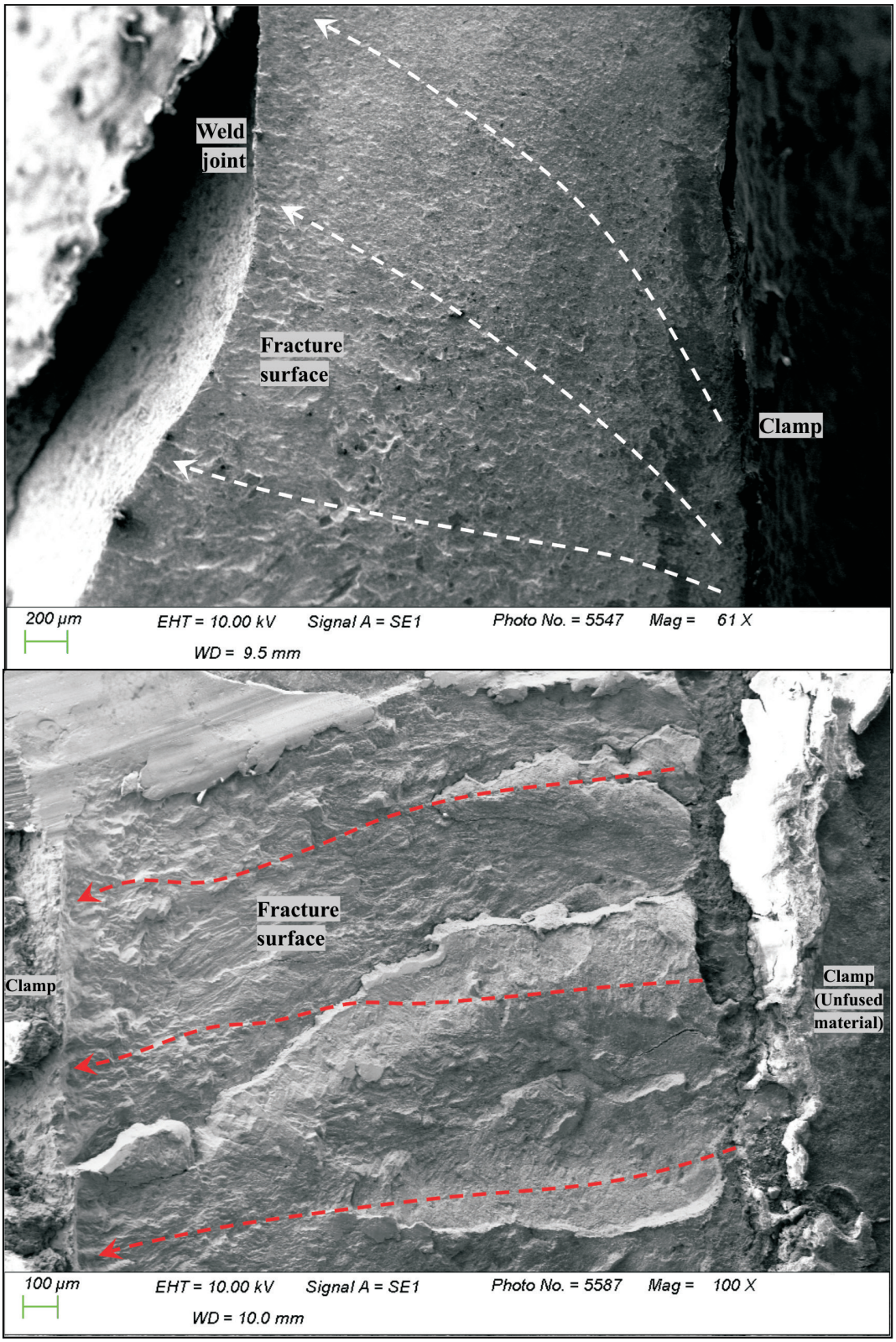


Fig.3d (contd.): SEM images of the fracture surface captured in the vicinity of some more failure origin(s). Direction of propagation of fatigue failure is indicated by dotted arrow marks.

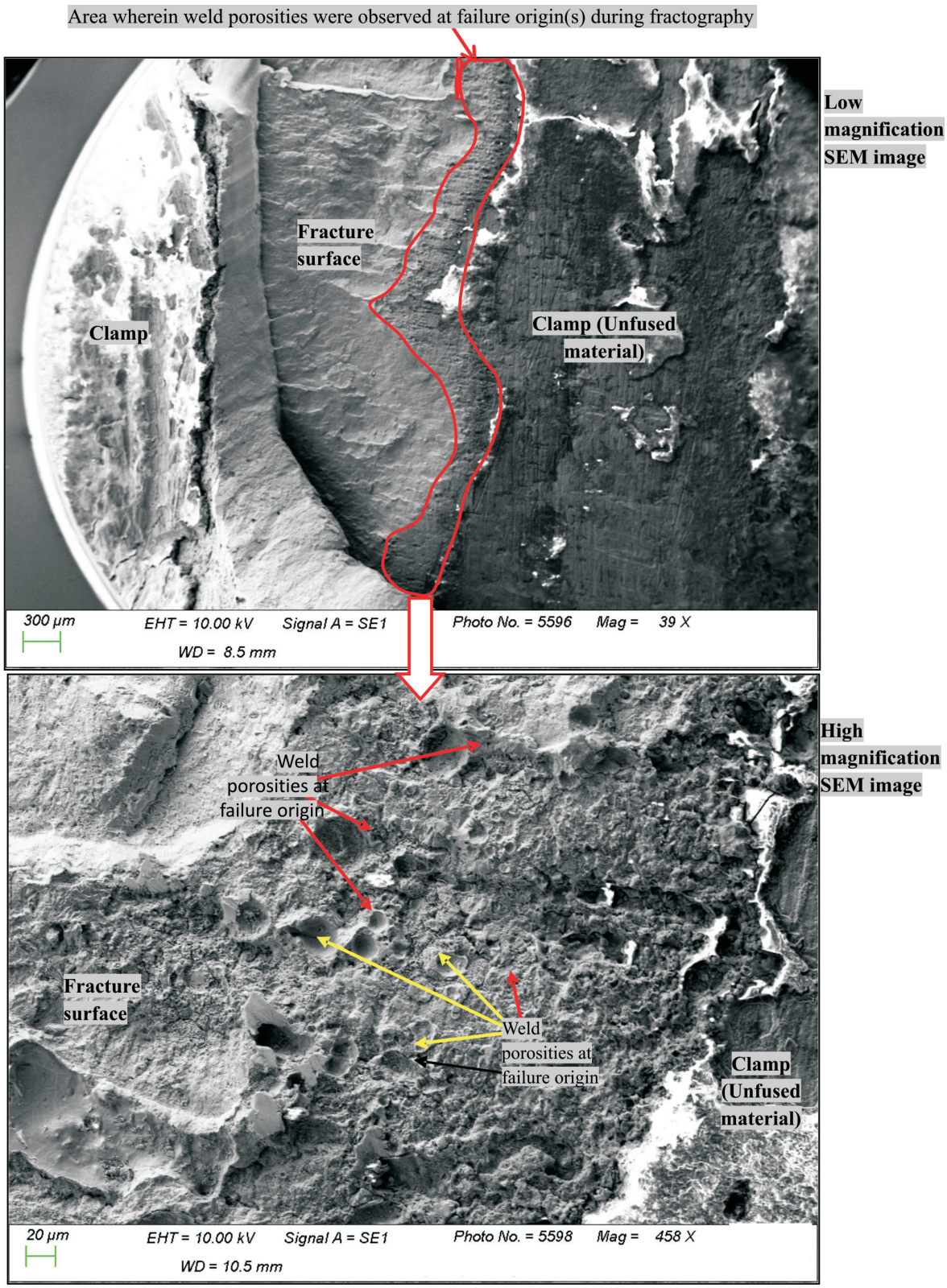


Fig.3d (contd.): Area wherein weld porosities were observed at failure origin(s) is encircled in the low magnification SEM image. High magnification SEM image showing weld porosities at the failure origin(s) is also given.

2.3. Weld Characterization

Sample was extracted carefully from lug-to-clamp weldment to assess its weld quality. This sample was mounted, metallographically polished and then etched. Photo-macrographs of the weld joint captured in both as-polished and etched conditions are given in Fig.4a. Gap observed between the lug and clamp and lack of fusion observed on clamp-side of the weldment are indicated in the figure. Lack of fusion of about 0.6 mm was observed beyond the root of the weldment as depicted in the photo-micrograph in Fig.4b. The weldment showed satisfactory penetration and was free from non-metallic inclusions.

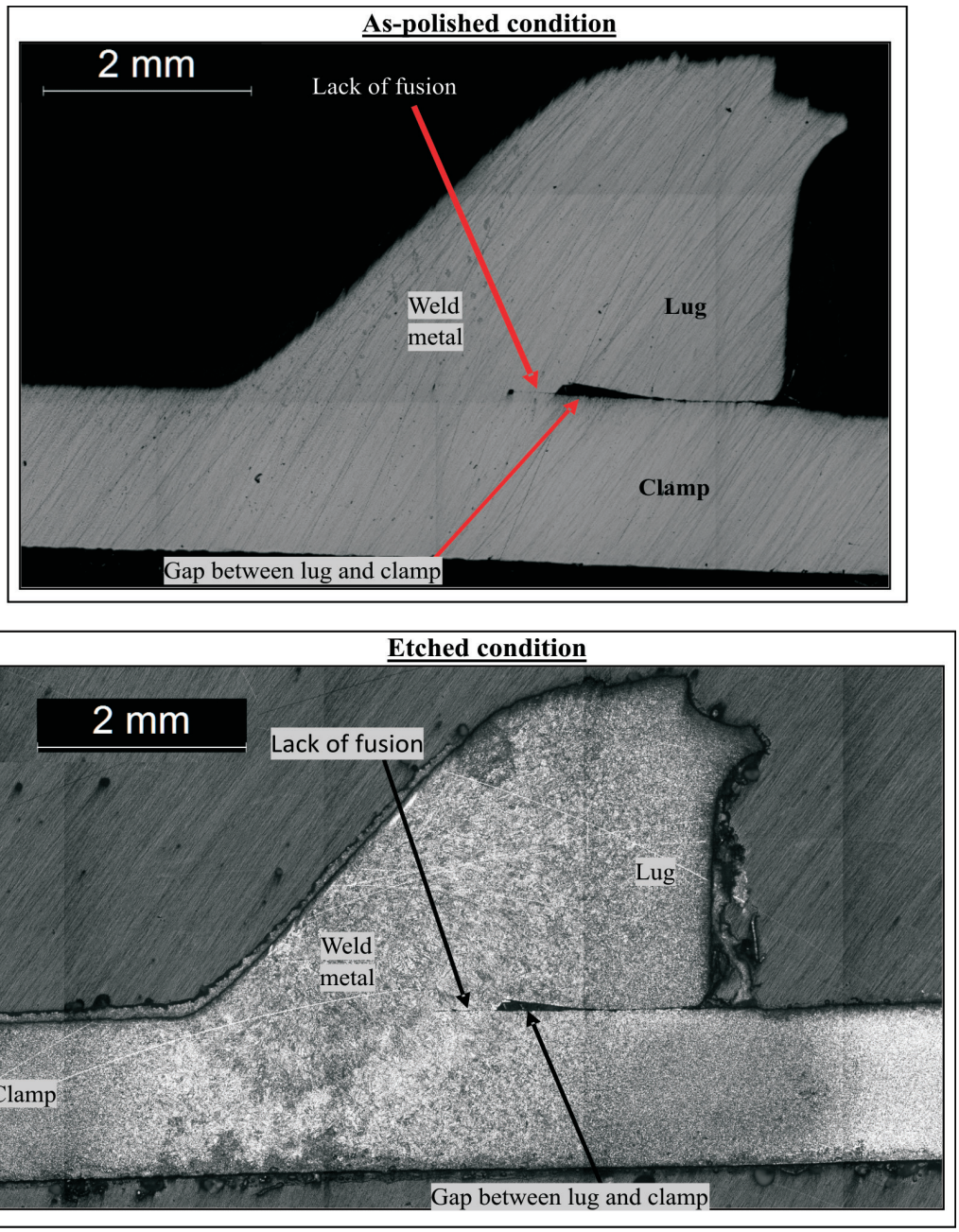


Fig.4a: Photo-macrographs of the lug-to-clamp weldment captured in as-polished and etched conditions [Etchant: Nital]

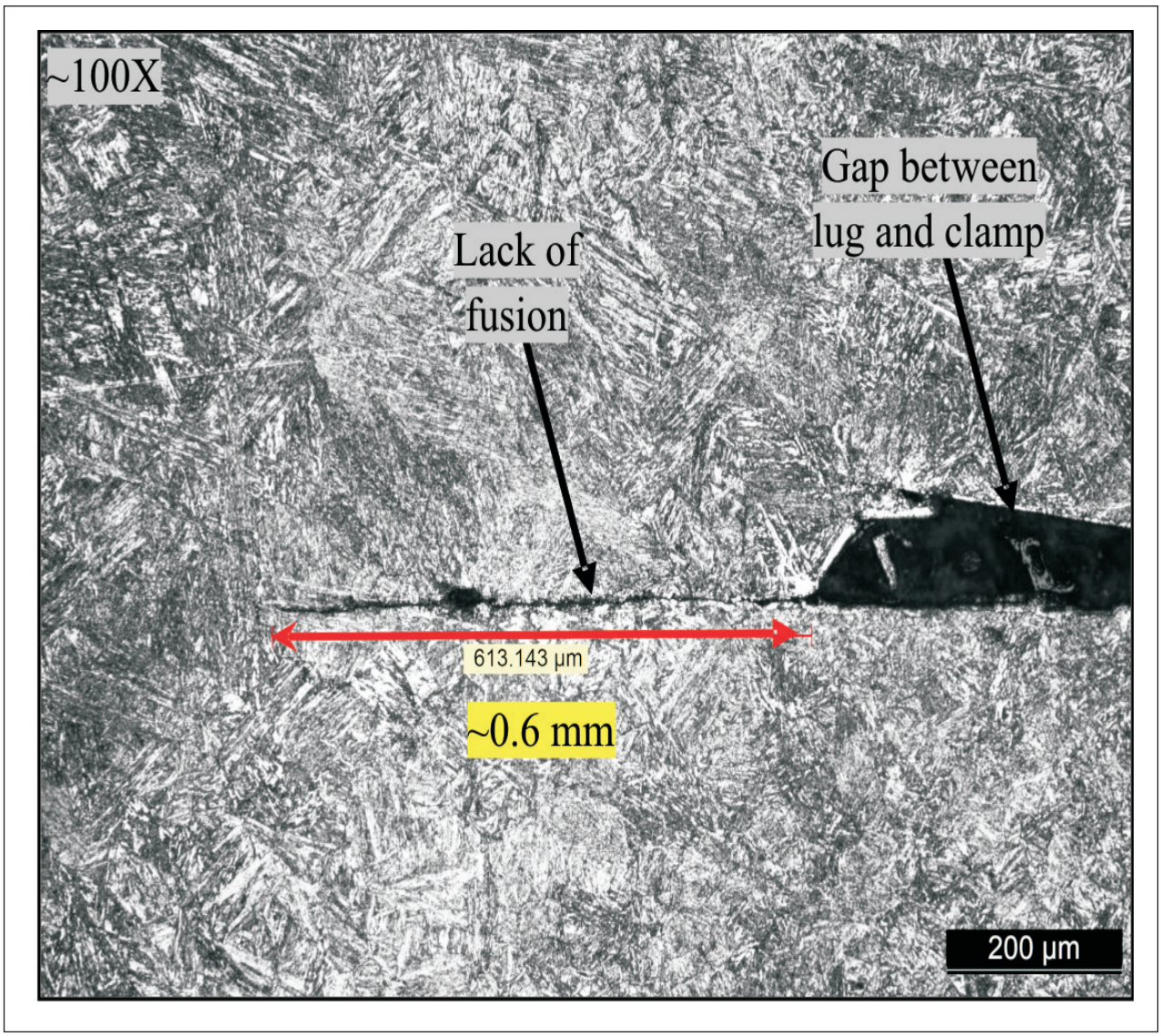


Fig.4b: Photo-micrograph showing lack of fusion on the clamp-side of weldment [Magnification:100X, Etchant: Nital]

Clamp of the lug assembly is 1.5 mm thick. Weld leg size on clamp-side of the weld joint was measured as 3 mm (Fig. 4a & 4b). Literature suggests that as a general rule, size of the weld leg should be equal to thickness of the metal being welded [4]. Therefore, in the present case, the weld leg size is relatively higher indicating overwelding, which induces more heat into the metal causing residual stresses that weakens the structure [4, 5].

Macro and micrographs in Fig. 4a-4b represent the sample extracted from section A-A of lug-to-clamp weldment and this section is indicated in Fig.4c. One more sample was extracted from Section B-B (located very close to the fracture) of the weldment and was metallographically polished and etched. Section B-B showed a minute crack originating from lack of fusion on clamp-side of the weldment as depicted in the photo-macrograph in Fig.4d. The crack had possibly initiated in-service and did not appear to be any weld-related defect. This corroborates with the fractographic findings that showed fatigue failure originating from unfused portion of the clamp in the weldment.

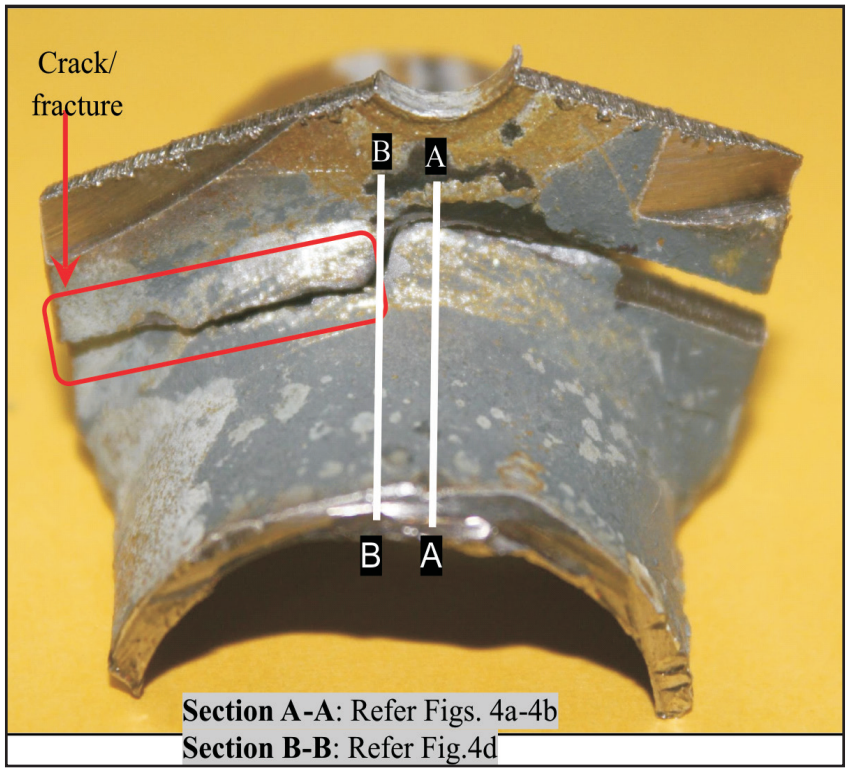


Fig.4c: Photograph depicting the sections (A-A and B-B) used for macro/ micro examination (weld characterization)

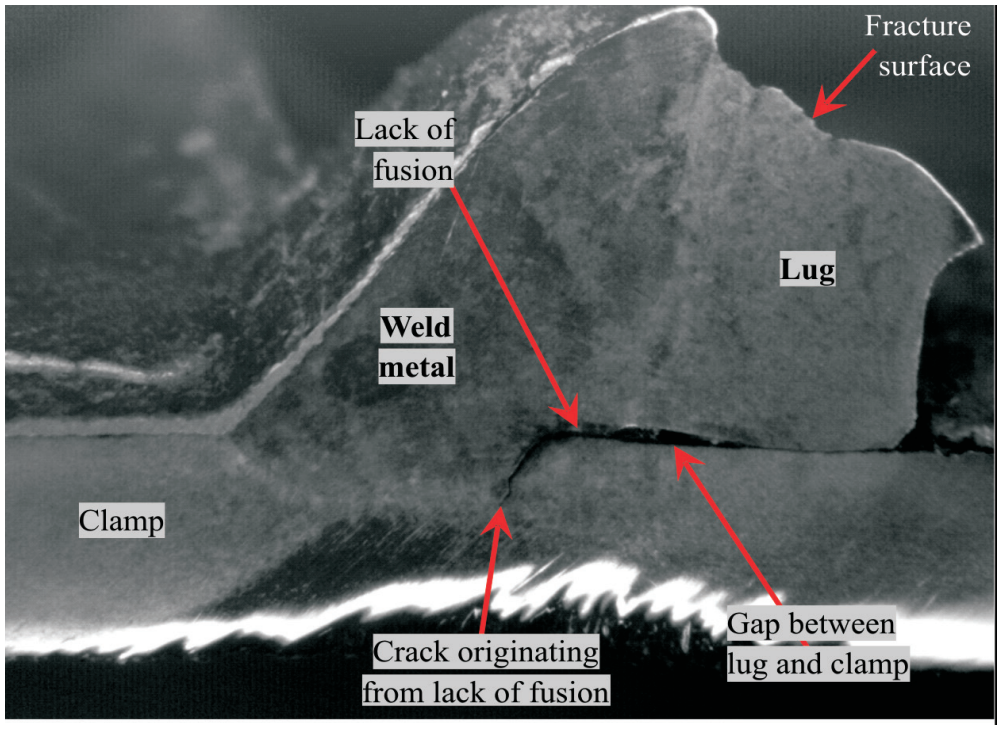


Fig.4d: Photomacrograph of section B-B of the weldment (refer Fig.4c) between lug and clamp [Etchant: Nital]

3. Analysis of the Observations

3.1. A Brief Summary

i. Crack was observed on lug-side of lug-to-clamp weld joint of the lug-assembly (Fig. 1 and 2b-2c). Fractographic studies (SEM analysis) showed that lug-assembly had failed by fatigue wherein failure had originated at multiple locations from the unfused portion of the clamp in the weldment (Fig. 3b-3d).

ii. During macro/ micro examination, lack of fusion was also observed towards clamp-side of the weldment and the crack (apparently service-related) was found initiating from this lack of fusion. (Fig. 4a-4b and 4d)

iii. Lack of fusion is a discontinuity between the weld and the base metals, so there is no path for load/ stress to transfer through the weld into the adjoining member [5, 6]. Further, in the present case, lack of fusion was in line with and in continuation with the gap observed between the lug and clamp in the weldment (Fig. 4a-4b and 4d). Therefore, this portion of the weldment was unable to take the stress. This would have resulted in shift in the stress axis towards the remaining (fused) portion of the weld joint resulting in bending moment and fatigue failure of the weldment.

iv. In addition to lack of fusion, weld porosities (micro porosities) were also observed at the failure origin(s) during fractographic studies. These would have contributed to the failure/ cracking. Improper shielding while welding, presence of moisture or improper cleaning of the work pieces prior to welding could be some of the reasons for weld porosities.

3.2. Recommendations

Lack of fusion and weld porosities observed at the fatigue crack origin(s) were detected at microscopic level through destructive tests. As it may not be possible to detect this level of defects in routine NDT and/or visual examination, following actions/ measures were suggested to prevent future recurrence -

i. Proper preparation of the workpieces to minimize gap between lug and clamp during welding to the extent possible.

ii. Proper pre-cleaning of the work pieces before welding to minimize lack of fusion. Protection from moisture and proper shielding during welding to minimize weld porosities.

iii. As adherence to vital weld geometries is important for a fillet weld; hence, weld quality tests to be performed periodically and even randomly (but at more frequent intervals.

iv. If design permits, welding on both sides of the fillet joint (between lug and clamp) to be explored. Alternatively, designer to explore the possibility of fabricating the lug-assembly through machining instead of by welding.

4. Conclusions

i. Chemistry, specification, hardness/strength and microstructure (heat-treatment condition) of the cracked lug met the specified requirements.

ii. Crack was observed in the lug-to-clamp weld joint of lug-assembly. Lug of the assembly had failed/cracked by fatigue that had originated at multiple locations from the unfused portion of the clamp in the weldment. Failure was also aided by the weld porosities observed at the failure origin(s).

iii. The 2 remedial measures suggested should able to address this failure and also, possibly provide a solution for no recurrence of such failures in future.

iv. It is advisable to monitor the future modified lug-assemblies with the suggested modifications for possible further modifications or a totally different set of remedial measures.

Acknowledgements

The authors express their sincere gratitude to Shri M.S. Venkatesh, Executive Director of Foundry & Forge Division, HAL, Bangalore for his encouragement and support in conducting failure analysis work in the laboratory and for permitting us to publish the case study. They also thank the editors profusely for their extensive corrections and appropriate rearrangement of the text of the manuscript.

References

[1] Anup Banakar K. and Dinesh Kumar, Static and Dynamic Analysis of Flight Control Circuit Mixing Unit in a Typical Light Helicopter, International Journal of Science and Engineering Applications, Volume 8, Issue 08, p.p. 269-271, 2019

[2] StudyCorgi (2022, March 17), Aircraft vs Helicopter Flight Control Systems, https:/ www.studycorgi.comircraft-vs-helicopter flight-control- systems/

[3] https://en.m.wikipedia.org/wiki/ Helicopter_flight_controls

[4] E.R. Bohnart, TIG Handbook for GTAW, Gas Tungsten Arc Welding (Miller Electric Manufacturing Company, Appleton, 2005), pp. 55–57

[5] Vaisakhi Nandi, R. R. Bhat, V. Ram Prasad, Failure Analysis of Weldment Crack in Body Structure of a Helicopter, Journal of Failure Analysis and Prevention, Vol.19, No.5, p.p. 1207–1217, October 2019, ASM International.

[6] P. Evans, Cracking Down on Weld Cracks (The Fabricator, FMA Communications, Inc., July 2012), https://www.thefabricator.com/ article/arcwelding/cracking-down-on-weld-cracks.

****

Down Memory Lane

In Memory of Prof. Somnath Misra (1936-2022)

- Dr. Sanak Mishra,
Former President of IIM; Former MD, Rourkela Steel Plant

Late Prof. Somnath Misra (11.01.1936 – 09.07.2022)

This article is in remembrance of Prof. Somnath Misra, former Principal of the Regional Engineering College at Rourkela (now National Institute of Technology) and previously Professor at Banaras Hindu University. Prof. Misra was not only an outstanding metallurgist as well as an eminent scientist, he was also a committed teacher and a competent administrator.

I first met Prof. Somnath Misra when he was in college and I was in school. Several years earlier, his elder brother had been adopted by my father's younger sister as her son; thus my father, the late Harihar Misra- an eminent educationist of Odisha, was a sort of mentor to the young Somnath.

Somnath Misra was born in 1936 in Puri, the abode of the deities Jagannath, Balabhadra and Subhadra. He passed the Matriculation (Class 11) examination from the Puri Zilla School in 1952, standing 1st Class First in the entire State. He then joined the Samanta Chandra Shekhara College in Puri for his I.Sc. (Intermediate Science) course, completing it in 1954 by securing the 1st Class 1st position in Utkal University. He then joined the Ravenshaw College, now Ravenshaw University in Cuttack for a B.Sc Honours degree course in Physics. In 1956 he graduated with 1st Class First position with Physics Honours, and also winning the Woodburn Prize as the Best Graduate in all subjects.

For his post-graduate degree, Somnath Misra pursued Metallurgy at the prestigious Indian Institute of Science, Bangalore, which was then popularly known as Tata Institute. He completed the degree of DIISc in 1958 as the class topper. He then joined as a Research Assistant at the Research & Control Laboratory of TISCO (now Tata Steel) in Jamshedpur. After a year, in 1959, he went to the Massachusetts Institute of Technology (MIT), USA as a graduate student of Metallurgy, with the award of a part-time research assistantship. He obtained a Master of Science (MS) degree in 1961 and a Doctorate in Science (Sc.D) degree in 1963. His thesis advisor was Prof. Michael B. Bever, a world-renowned figure in liquid tin solution calorimetry and the stored energy of cold work in metals --- areas in which Somnath Misra conducted his graduate research. On completion of his Sc.D degree, he worked as Research Associate at MIT for one year and then joined Union Carbide Corporation, New York as a Nuclear Metallurgist.

By this time, Prof. Tanjore Ramachandra Anantharaman, one of his teachers at the IISc, Bangalore had moved to the Banaras Hindu University (BHU) as the Head of the Metallurgy Department. Dr. Misra accepted Prof. Anantharaman's offer to return to India and joined BHU as Reader in the Metallurgy Department in July 1965. He was promoted in 1970 to the position of a full Professor at 34. In 1972, he received the National Metallurgists' Day Award of the Ministry of Steel for his contributions to the understanding of the thermodynamic properties of metals, having set up an experimental liquid metal calorimeter at BHU.

In October 1974 Prof. Somnath Misra took over as the Principal of the Regional Engineering College (REC) at Rourkela, which had been established at the initiative of the dynamic visionary Shri Biju Patnaik on 15 August 1961. Shri Patnaik had envisaged that the REC, apart from imparting engineering knowledge and skill, will also have a close relationship to the newly operating Rourkela Steel Plant. With this in mind, by the time Prof. Misra joined REC, some industry-oriented M.Tech courses like Machine Design, Furnace Technology, etc. had been introduced. To facilitate the employees of Rourkela Steel Plant to take up advanced degree

programs in these subjects, Prof. Misra introduced part-time and evening courses.

During his tenure of twenty-two years as Principal of REC Rourkela, Prof. Misra steered the college to new heights of capability and academic excellence. In 1975, he introduced a state-level entrance examination for admission to the REC for the first time. He was instrumental in installing a fourth generation VAX 11/780 computer in 1980, the first among all RECs. It was also his initiative that this REC was the first among RECs to introduce courses in MCA (1981) and Computer Science & Engineering, apart from the Bachelor degree courses in Mining Engineering, Ceramic Engineering, Applied Electronics and Instrumentation.

At this time, the RECs were not autonomous but academically affiliated with a nearby university. With a great deal of persuasive effort, in 1992 Prof. Misra succeeded in REC Rourkela becoming academically independent of the affiliating University of Sambalpur, by converting it as the first Autonomous College in Odisha.

After his superannuation from REC Rourkela in 1996, Prof. Somnath Misra continued to remain active in the educational field. He was invited by IIM to deliver the Prof. Daya Swarup Memorial Lecture at the National Metallurgists' Day Celebrations on November 14, 1996, on the occasion of IIM's Golden Jubilee Year. At the invitation of IIT Kharagpur he served the institute as the Tata Chair Professor during the late 1990s.

The Biju Patnaik National Steel Institute (BPNSI) was established by the Ministry of Steel in Puri at the initiative of the then Honb'le Union Minister of Steel, Shri Braja Kishore Tripathy. The vision and mission were to admit engineering graduates/ diploma holders to impart them with the knowledge of iron-making, steel-making, rolling, and steel fabrication to generate much the needed human resource for ferrous industries. He joined the institute as its Director on January 1, 2020 and led the nascent body with full commitment for the next three years. During this period I had the privilege as a member of its Governing Board to have a number of meaningful interactions with him.

In 2020 Prof. Misra was conferred the Lifetime Achievement Award by NIT Rourkela for his outstanding services to this institution.

Prof. Somnath Misra passed away on July 9, 2022. Besides being a tall figure in the metallurgical community, he was a soft-spoken and affable person much loved by his students and much admired by his peers. His legacy is sure to continue through his students and colleagues.

****

रक्षा अनुसंधान एवं विकास संगठन
रक्षा मंत्रालय, भारत सरकार
DEFENCE RESEARCH & DEVELOPMENT ORGANISATION
Ministry of Defence, Government of India

Aeronautics Research & Development Board

Vision

Make India technologically strong by establishing world class cutting edge aeronautical science and technology base to provide our Defence, Space and Civil Aviation sectors a decisive edge by equipping them with internationally competitive systems and solutions.

Mission

To encourage and fund basic and applied research in pertinent scientific disciplines directly relevant to our aeronautical systems needed for future by enabling and supporting emerging talents, particularly in academic and research institutions to create and evolve a potential knowledge-base system applicable to future aeronautics needs of the country.

Charter

•To formulate research, design and development programmes in aeronautics and allied sciences, keeping in view future needs of the country specifically with respect to aircraft, helicopter, missiles and all other airborne vehicles.
•To implement such programmes through appropriate institutions and individuals by sponsoring research, design and development projects, creating/ improving infrastructure facilities deemed necessary, while ensuring that they are suitably monitored.
•To promote in all possible ways such educational and training programmes as may be considered necessary for ensuring that adequate manpower of requisite quality becomes available to various aeronautical organizations in the country.
•To promote all relevant R&D activities in the country through appropriate scientific meetings, provisions of support for participation of Indian and foreign scientists in such meetings, conduct of relevant competitions as well as other training and visiting programmes within India and abroad as may fall within the scope of the programmes mentioned at sub para (a) above.
•Dissemination of appropriate technical information through journals and documents, encouragement of individual and collective efforts and nurturing of young talent by institutions with suitable awards, scholarships etc. Organization of necessary centralized services related documentation, software, data-link etc. and in all such other ways that the Board may determine from time to time.

Panels & Chairmen (2017-2022)	
Aerodynamics Panel **Dr S Pandian** Prof. Vikram Sarabhai Distinguished Professor & Ex- Director & DS, SHAR	**Propulsion Panel** **Dr V Ramanujachari** National Centre for Combustion Research & Development (NCCRD), IIT Madras, Chennai
Aerospace Resources Panel **Dr N Eswara Prasad** OS & Ex-Director, DMSRDE (DRDO), Knp.-13	**UNMANNED AERO SYSTEMS PANEL** **Shri PS Krishnan** DS & Ex-Director, ADE, Bangalore-560075
Materials & Manufacturing Panel **Dr DK Das, Scientist H** Group Head (DSG), DMRL (DRDO) Hyd. - 58	**Structures Panel** **Dr Makarand Joshi** Scientist G, R&DE (E), DRDO, Pune-411015
GTMAP **Prof. Amol A Gokhale, IITB, Chairman**	**Systems / Systems Engineering Panel** **Shri APVS Prasad** Scientist H, CE, CEMILAC, DRDO, Bangalore

3D Printed Custom MEMS

Researchers at KTH Royal Institute of Technology in Stockholm, developed a technique to cost-effectively print custom electronic "machines" the size of insects that enable advanced applications in robotics and medical devices.

The researchers built on a process called two-photon polymerisation which can produce high-resolution objects as small as a few hundreds of nanometers in size, but not capable of sensing functionality. To form the transducing elements, the method uses a technique called shadow-masking, which works something like a stencil. They fabricate features with a T-shaped cross-section on the 3D printed structure, which work like umbrellas. They then deposit metal from above, and as a result, the sides of the T-shaped features are not coated with the metal. This means the metal on the top of the T is electrically isolated from the rest of the structure.

Frank Niklaus, who led the research, says with this method it takes only few hours to manufacture a dozen or so custom designed microelectromechanical systems (MEMS) accelerometers using relatively inexpensive commercial manufacturing tools. The method can be used or prototyping MEMS devices and manufacturing small- and medium-sized batches of tens of thousands to a few thousand MEMS sensors per year in an economically viable way, he says.

"This is something that has not been possible until now, because the start-up costs for manufacturing a MEMS product using conventional semiconductor technology are of the order of hundreds of thousands of dollars and the lead times are several months or more", he says. The new capabilities offered by 3D-printed MEMS could result in a new paradigm in MEMS and sensor manufacturing.

"Scalability is not just an advantage in MEMS production, it is a necessity. This method would enable fabrication of many kinds of new, customised devices".

Source: ASM International
(Sent by Dr. R R Bhat)

New Material Thinks for Itself

Researchers from The Pennsylvania State University and U.S. Airforce are developing engineered materials that can think, similar to how humans respond to touch. The work relies on a novel, reconfigurable alternative to integrated circuits. According to lead researcher Ryan Harne, his team's discovery revealed the opportunity for nearly any material to act like its own integrated circuit – being able to "think" about what's happening around it. They have created the first example of an engineering material that can simultaneously sense, think and act upon mechanical stress without requiring additional circuits to process such signals. "The soft polymer material acts like a brain that can receive digital strings of information that are then processed, resulting in new sequences of digital information that can control reactions", Harne says.

The conductive mechanical material contains reconfigurable circuits that can realise combination logic – when the material receives external stimuli, it translates the input into electrical information that is then processed to create output signals. The team demonstrated how the material could use mechanical force to compute complex arithmetic or detect radio frequencies to communicate specific light signals, among other potential translation examples. According to the researchers, the possibilities are expansive, because integrated circuits can be programmed to do so much. Harne says that the material has potential applications in autonomous search-and-rescue systems, infrastructure repairs, and even in bio-hybrid materials that can identify, isolate and neutralise airborne pathogens. The researchers are now evolving the material to process visual information like it does physical signals.

Source: ASM International
(Sent by Dr. R R Bhat)

Metals that fight fungal infections

In an effort to encourage the development of antifungal and antibacterial agents, researchers at the University of Queensland in Australia have founded the Community for Open Antimicrobial Drug Discovery (CO-ADD). The ambitious goal of the initiative is to find new antimicrobial active agents by offering chemists worldwide the opportunity to test any chemical compound against bacteria and fungi at no cost. As lead researcher Angelo Frei explains, the initial focus of CO-ADD has been on organic molecules. However, he is trying to develop new metal-based antibiotics with his research group at the University of Bern, Switzerland and has found that over 1000 of the more than 300,000 compounds tested by CO-ADD contained metals.

The researchers tested 21 highly active metal compounds against various resistant fungal strains. These included cobalt, nickel, rhodium, palladium, silver, europium, iridium, platinum, molybdenum and gold. The most active compounds were then tested in a model organism – the larvae of a wax moth. Researchers observed that just one of the eleven tested metal compounds showed signs of toxicity, while the others were well tolerated by the larvae. In the next step, some metal compounds were tested in an infection model, and one compound was effective in reducing the fungal infection in larvae. "Our hope is that our work will improve the reputation of metals in medical applications and motivate other research groups to further explore this large but relatively unexplored field", says Frie.

Sou*rce: ASM International*
*(Sent by Dr. R R Bh*at)

****

Chapter Activities Kanpur, Kalpakkam

Kanpur Chapter

The IIM Kanpur Chapter organised two technical talks recently. The venue of both the meetings was @ FB421 (Conference room, Department of Materials Science and Engineering), IIT Kanpur.

1) On 5th January 2023 the talk was delivered by Dr. Rama Srinivas Varanasi, Postdoctoral Researcher at the Institute for Materials Research (IMR), Tohoku University. The title of the talk was "Understanding the heterogeneous nucleation mechanisms in medium manganese steels".

2) Dr. Swati Sharma, Assistant Professor at IIT Mandi delivered the talk on January 27, 2023 on the topic "Carbon-based flexible microdevices for energy storage and sensor applications".

Kalpakkam Chapter

The Indian Institute of Metals, Kalpakkam Chapter organised a half-day technical event for PhD research scholars on "Current Advances in Materials and Processing-CAMP-2022-23" at IGCAR, Kalpakkam on 17th January 2023. Total 5 talks were presented by the research scholars from various divisions of MMG and MSG. The theme Meeting for research scholars of IIM Kalpakkam was organised with an objective of providing a platform to present their research findings and enable interactions with peers and senior members of the chapter. The programme was designed to cover a broad range of topics in the field of metallurgy and allied areas. Dr. R. Divakar, Director, MMG & MSG delivered opening remarks for the programme and a brief address to the research scholars.

The technical event started with the presentation from Ms. P. Vaishali, MDD/MMG on "Comprehension of deformation and damage occurrence in P91 weld joint under various cyclic loading waveforms". Then, Mr. Choudhury Abinash Bhuyan, SSSD/MSG delivered his presentation on "Ultra-cleaned transferred monolayer-MoS2 for field effect-transistor applications". Mr. Paulson Varghese CSTD/MMG delivered a talk on "Laser surface modification and optimization to enhance the liquid-sodium compatibility of plasma sprayed ceramic

coatings". Mr. Aishwary Vardhan Pandey, PIED/ MMG presented his work on "Recent Developments in Small Punch Testing". The final talk was from Mrs. Vijayachandrika, NDED/MMG on "Development of remote field eddy current array probe for imaging anomalies in ferritic steel tubes". All the talks were informative and the peers and senior members interacted with all the speakers in a constructive way.

Dr. Nagesha, Head, MMD awarded Mementoes and Certificates to all the 5 speakers. He motivated the scholars, appreciated their efforts and wished them all success for their current and future research works. Mrs. G. Shanthi, proposed a vote of thanks and thanked the research scholars for sharing their knowledge. The event was well accepted amongst the research scholar's community and IIM members of MMG and MSG.

Glimpses of CAMP 2022-23

****

Advertisers' Index	
Name of the Organisations	*Page Nos.*
ARP/AR&DB, DMSRDE	**21**
Chennai Metco Pvt Ltd	**30**
Rashtriya Ispat Nigam Ltd	**31**
Tata Steel Ltd	**32**
Hindalco Industries Ltd	**4th Cover**

India identifies copper and lithium mines in Argentina; to acquire soon

India has identified two lithium mines and one copper mine in Argentina, and it may acquire or lease them soon, a report by BusinessLine (BL) said. In November 2022, the Indian government sent a team of geologists to South America to "assess potential lithium deposits".

The report cited officials of the ministry of mines as saying that the ownership or leasing rights of the mines will be with Khanij Bidesh India Ltd (Kabil). It is a joint venture of the National Aluminium Company (Nalco), Hindustan Copper (HCL) and Mineral Exploration Corporation Ltd (MECL). It was formed in 2019 to ensure the supply of strategic minerals in India's market.

"Subsequent to preliminary assessment, Kabil expressed interest to partner with a state-owned organisation there in December for prospecting the identified areas and exploring the possibility of establishing projects for extraction of lithium in due course of time. Commercial evaluation of the same has begun at our end here," the official told.

Kabil also signed three agreements with Argentina government-run companies JEMSE, Camyen and YPF between July and September 2020 to explore sourcing of lithium and other mineral assets in the South American country. Kabil is also reportedly in the process of hunting joint lithium mining projects in Chile.

Business Standard

Steel cos seek import duty hike to counter dumping

The domestic steel industry has requested the government to increase the basic customs duty on steel imports and levy an additional 25% safeguard duty on the alloy in the upcoming Union budget to counter dumping of steel from countries such as Japan, South Korea, China and Russia into the Indian market.

The import duty on finished steel products was slashed to 7.5% in the budget for 2021-22. The Indian Steel Association (ISA), a lobby for domestic steelmakers, has written to the finance minister, requesting to restore the duty to 12.5% for flat steel products and increase it to 10% for long products.

About 60% of the steel imports come from countries which India has a free trade agreement with, thus attracting zero basic customs duty. To counter dumping from these countries, steelmakers want a 25% safeguard duty on imports.

Steel imports surged 40% year-on-year to 5 million tonnes in April-December 2022, as per data from the Joint Plant Committee, a government-backed institution. Meanwhile, exports plunged 60% to 6 million tonnes during this period, primarily due to the imposition of a 15% export duty by the government which has since been revoked.

India became a net importer of steel during the December quarter, with imports displacing 8% of the domestic steel demand, said the association.

Steelmakers argue that several countries are dumping their excess steel production into India at prices far lower than in their own domestic markets. With imported steel becoming cheaper, domestic manufacturers claim that they are being forced to cut prices to unsustainably low levels.

"Globally, things are not OK, but India is doing well. So, it is a target, and more and more steel will come to India if the government doesn't take any action," Seshagiri Rao, joint managing director of JSW Steel, told ET in a recent interview.

The Economic Times

Hindustan Copper signs MoU with IIT (ISM) Dhanbad to enhance copper ore production

State-owned Hindustan Copper Limited (HCL) and the Indian Institute of Technology (IIT) (Indian School of Mines), Dhanbad, on Wednesday signed a Memorandum of Understanding (MoU) for technical collaboration to increase the state-owned firm's copper ore production.

This is the first technical collaboration between the two organisations. HCL is the only copper miner in India and owns all operating mining leases for copper ore in the country.

At present, majority of ore production comes through from underground, with an estimated 4 million tonne produced annually. However, due to complex geological characteristics of the ore body and increased depth of mining, various geo-technical and ground water related issues along with technical/ operational problems are being faced during the process of production along with maintaining safety standards and dealing the emerging sustainability issues.

HCL plans to increase its ore production capacity threefold in the coming years wherein development activities in projects are either on-going in nature or already planned in most of its mines.

At present, the mined out ore is processed at the company's ore beneficiation plants and metals in concentrate is sold in domestic and international markets.

IIT-ISM, Dhanbad, being an institute of national repute, particularly in the fields of mining of minerals and its beneficiation and Earth Sciences, will play a key role in solving the emerging geological, technical, environmental, sustainable and ore beneficiation issues for achieving the envisaged expansion programme of HCL.

https://www.livemint.com/

Increased capex to boost domestic steel demand, generate employment: Steel industry

The increased capex allocation of Rs 10 lakh crore announced in the Union Budget will lead to pick up in demand for steel and generate employment in the country, steel industry said. Finance Minister Nirmala Sitharaman tabled the Union Budget for 2023-24 in Parliament.

"A significant 33 per cent increase in capital expenditure to Rs 10 lakh crore -- 3.3 per cent of the GDP -- thrust to fast-track infrastructure development, and the highest ever Rs 2.40 lakh crore for railways will translate into robust domestic steel demand, thus spurring private investments and job creations," said Dilip Oommen, CEO of AMNS India and Executive Vice President of ArcelorMittal.

First- and last-mile connectivity for sectors like steel, ports, coal, etc. with an investment of Rs. 75,000 crore will improve logistics efficiency, he said.

Anil Chaudhary, Chairman, Metals and Minerals Committee, PHDCCI, and Group CEO, Metals & Mining, Essar Capital, said the overall capital outlay of Rs 13.7 lakh crore will spur the growth of infrastructure and construction sector in the country, and the direct beneficiary of which will be the domestic steel industry.

The finished steel consumption is expected at 118 Mt in the ongoing fiscal. It will reach a level of 132 Mt in the next 2023-24 financial year.

JSW Group Chairman Sajjan Jindal said: "The 40 per cent increase in the income tax rebate limit from Rs 5 lakh to Rs 7 Lakh is a huge comfort that this budget has given to our middle-income group and is a great step to strengthen their finances."

The Economic Times

Government gets multiple EoIs for privatising NMDC Steel

The government has received multiple Expressions of Interest (EoI) for the proposed strategic disinvestment of NMDC Steel Ltd (NSL), the Department of Investment and Public Asset Management (Dipam) said.

The transaction will now move to the second stage, Dipam secretary Tuhin Kanta Pandey said in a tweet.

The government had on December 1, 2022, invited preliminary bids or EoIs for strategic sale of NSL - the steel manufacturing facility of India's largest iron ore producer NMDC, located in Nagarnar, Chhattisgarh. The last date for putting in bids was January 27.

The Centre holds a 60.79% stake in NSL. It is looking to sell 50.79% shareholding in the company along with management control.

The Ministry of Corporate Affairs had in October last year approved the demerger of the steel manufacturing unit at Nagarnar from NMDC. Subsequent to the demerger, shares of NSL will be

listed on the BSE, NSE, and Calcutta Stock Exchange. As per current estimates, the targeted date for commissioning of the steel manufacturing plant NSL is March 31, Dipam said.

The Economic Times

JSW Steel placed in a very bright spot, says Joint MD Seshagiri Rao

After improving its financial performance in October-December 2022 over the previous quarter, JSW Steel is placed "in a very, very bright spot", said its joint managing director Seshagiri Rao.

The company is on course to achieve its highest-ever production in the current quarter, as the new manufacturing capacity commissioned during the previous quarter will be available throughout this period, Rao told ET. This includes expanded capacity at subsidiary Bhushan Power and Steel as well as new coking ovens, he said.

That would translate to 6.35 million tonnes of crude steel production and 7 Mt of sales, both the highest-ever for the company.

In the December quarter too JSW Steel had recorded its highest-ever steel production at 6.14 million tonnes. Meanwhile, the anticipated sale of 7 million tonnes of steel during the current quarter would be over a million tonnes more than the 5.6 million tonnes of steel sold in the previous quarter.

At the same time, prices of coking coal, a key raw material, for orders placed for this quarter's inventory are also favourable, said Rao. "So, we will do better volume-wise, product-mix wise, and on the cost side too we will do very well," he said.

In 2023-24, the company's performance is expected to improve further as its expanded production capacity of 28.5 million tonnes will be available throughout the year, he said, adding that the company plans to commission about 9 million tonnes of capacity next fiscal.

"So in 2024-25, you will find a huge volume growth which no other company will have," said Rao.

The Economic Times

JSW Steel's export push can sustain rebound

After a tough first half of FY23, India's leading steel producer JSW Steel showed some recovery in the December quarter. The momentum could continue in near term, with the company looking to increase its export after the recent removal of export duties and uptick in global demand after Chinese economy showed signs of opening up. But upside may be capped due to expected slowdown in 2023.

For the December quarter, the company's Ebitda rose by 160% sequentially to ₹4,547 crore, although down sharply over last year's corresponding quarter. Lower raw material costs helped. But several cost-saving investments which it commissioned also have started showing. Revenues stood at ₹39,134 crore, down 6% QoQ and net profit at ₹474 crore vs loss of ₹915 crore.

It produced 6.14 million tonnes - highest ever - and 10% higher sequentially. Higher utilization in Dolvi plant and restarting of JSW Ispat Special Products helped. It increased capacity at Bhushan Power and Steel by 0.75 mtpa to 3.5 mtpa, taking capacity to 28 mtpa. Higher production led to higher inventories of 7 Mt.

"In Q4, we will try reducing this inventory and push more in international market as international prices have picked up and 15% penalty on export is not there," said Seshagiri Rao, joint MD, JSW Steel. The company's export has fallen to 7% of sales in December quarter from 23% last year. The company has guided for a 6.34 Mt for March quarter vs 6.06 Mt in December quarter. In terms of sales volumes, guidance is 7 Mt against 5.5 Mt. "Rich product mix, cost-saving measures and better prices should help in this quarter," he added.

Chinese steel prices have risen to $640 a tonne from $530 in November 2022. Will price sustain? Prices may sustain but unlikely to see previous high, said Rao, citing expected slowdown and unlikelihood of investment-related growth in China.

The Economic Times

Odisha approves 9 investment projects worth Rs 1.53 lakh crore

The Odisha government approved nine investment projects worth Rs 1.53 lakh crore including a Rs 38,000 crore proposal of ArcelorMittal Nippon Steel (AMNS) India Ltd, an official said.

The high level clearance authority (HLCA) of Odisha led by Chief Minister Naveen Patnaik has approved these projects that would generate employment for over 27,000 people in the state.

The HLCA has given a go-ahead to four projects in the green energy and equipment sector, two projects in the paper industries, two projects in the metals and minerals sector and one project in the IT infrastructure sector. The project intents were received during the Make in Odisha Conclave, 2022.

According to officials, the proposal of ArcelorMittal to set up a 7 million tonne per annum (MTPA) steel plant in Jagatsinghpur district of Odisha has been approved. This project is expected to churn employment opportunities for 11,000 people.

Similarly, the state has approved the proposal of Rungta Metals Private Limited (RMPL) for the expansion of its integrated steel plant from 0.5 MTPA to 1 MTPA in Rairangpur of Mayurbhanj district with an investment of Rs 1,140 crore.

The committee has approved the proposal of ACME Clean Energy Private Limited, entailing an investment of Rs 58,209 crore. The company has proposed to set up a green hydrogen plant and a green ammonia plant with a capacity of 1.1 million metric tonne, at Kujanga in Jagatsinghpur district and 4,500 MW solar power plants at Koraput and Kalahandi districts.

The state has also approved the proposal of Avaada Green H2 Private Limited at Ganjam district, which promises an investment of Rs 23,500 crore.

The two other green energy projects will be set up by Renew EFuels Private Limited (REFPL) with an investment of Rs 20,000 crore and Ocior Energy Private Limited with a cost of Rs 7,200 crore.

The Economic Times

India's Jindal Stainless expects exports to hit five-year high

India's Jindal Stainless Ltd expects its exports to reach a five-year high in the next fiscal year, buoyed by increased shipments to Russia and its plans to enter markets in South America and the Middle East.

India's biggest stainless steel manufacturer expects its exports to jump to 25%-30% of overall sales in the fiscal year beginning April, from an estimated 12% in the ongoing fiscal year, Abhyuday Jindal, managing director of Jindal Stainless, told Reuters in an interview.

"We are seeing some good recovery happening, and we expect exports to be back to 25%-30% from April onward," Jindal said. "Russia has opened up. Certain shipping lines have opened up. Banking channels have opened up," Jindal said. "For Russian buyers, our company is a much-preferred supplier than the Chinese."

Russian steel demand is recovering after Western sanctions over Moscow's invasion of Ukraine caused buyers difficulty in securing supplies. Jindal Stainless expects Russia's share in its overall exports to rise to 25% from between 15% and 20% now, he said, with 90% of payments for Indian steel made in euros and some in the U.S. dollar. It had tried to persuade Russian steel buyers to trade in rupees.

Apart from boosting its shipments to Russia, Europe and the United States, the company aims to enter markets in South America and the Middle East in the coming fiscal year, Jindal said.

"Although the United States is still a very big market and I think there is more space to grow there, we are also looking at South America, and the Middle East," he said.

Jindal said the company plans to sell cold-rolled coil and sheets to its newer markets.

Expressing concerns over Chinese dumping, or sales at an artificially low price, Jindal said, "The Indian market is small, and there is severe dumping happening from China."

In December, New Delhi imposed anti-dumping import duties on stainless steel seamless tubes and pipe imports from China. India has also launched four investigations into possible dumping against Chinese stainless steel imports. But local steelmakers say the measures have failed to curb cheaper Chinese imports.

The Economic Times

India's crude steel output grows to over 124 Mt in 2022; consumption rises to 106 Mt: SteelMint

India's crude steel production rose by 5.80 per cent

to 124.45 Mt in 2022, according to SteelMint. The country had produced 117.63 Mt crude steel in 2021, the market research firm said.

The production of finished steel was at 110.03 Mt, up from over 104.54 Mt a year ago, SteelMint said in its latest report.

The consumption of finished steel rose to 106.48 Mt, as against 98.39 Mt in 2021, a year-on-year rise of 8 per cent.

According to the report, the exports in 2022 have registered a fall over the previous year, while the imports have grown in the year ended December 31.

At 4.77 Mt, the imports were 21 per cent higher against 3.94 Mt in 2021.

The Economic Times

Centre to push primary steel producers to use 50% of input from recycled steel by 2047, says Scindia

Union Steel Minister Jyotiraditya Scindia said his ministry will push primary steel producers to use 50 per cent of their input from scrapped/recycled steel by 2047 to help achieve the government target of moving into a circular economy. Currently, the level of recycled steel usage in primary steel production is only around 10 per cent even though recycled steel contributes to 22.5 per cent of the domestic total steel production of 140 million tonnes, the minister said while addressing the last day of the three-day international conference of material recycling here.

The 10th conference is being organised by the Material Recycling Association of India and is attended by over 2,000 delegates from 38 countries.

Noting that recycling is the key cog in the wheel of manufacturing as economies move into a circular model of development, he said, "Going forward the industry should focus on the 6Rs philosophy of reduce (exploitation of natural resources), recycle, reuse, recover, re-design and reinforce".

He said the government is committed to reducing CO2 emissions in the steel sector by 5 per cent by 2030 from the current 2.85 to 1.4 CO2/tonne of crude steel, and to achieve this recycling scrap steel is an extremely important source.

"Today, scrap usage is only 15 per cent in primary steel production. We will push the steel industry to increase this to 25 per cent in the next five years, and by 2047, this should double to 50 per cent. This means that the primary steel producers consume only 50 per cent of iron ore by then," Scindia said.

This is needed as the natural resources are finite and the demand looks infinite, he said, adding the steel industry has the biggest role to play in the whole process.

The country currently produces 25 million tonne of scrap steel and annually imports 5 million tonne of scrap steel with zero import duty, he added.

The Economic Times

India's finished steel exports slump 52% during April-January

India's finished steel exports more than halved during the first 10 months of the fiscal year that began in April 2022, due to sluggish global demand, according to the latest government data seen by Reuters. The country's steel exports fell 52.2% to 5.33 million tonnes between April and January, with the removal of an export tax in November failing to revive exports.

Despite that, India, which is the world's second-biggest producer of crude steel, was a net exporter of the alloy during the April-January period.

In May last year, New Delhi raised the export tax on some steel intermediates, impeding overseas sales and impacting the financial health of India's steelmakers, which reported a drop in profits in the December quarter.

But most steel companies, including JSW Steel Ltd, India's biggest steelmaker by capacity, have projected a pick-up in overseas sales in the current quarter through March.

Between April and January, India's finished steel output increased 5.2% to 98.3 million tonnes, and consumption went up by 10.8% to 96.4 million tonnes, the data showed.

India imported 5 million tonnes of finished steel during the period, up 28% from a year earlier. Crude steel production was up 4.2%, at 103.2 million tonnes.

The Economic Times

****

Seminars & Conferences

International Conference on Sintering and Pelletizing (ICSP 2023)

A two-day international conference on sintering and pelletizing (ICSP 2023) kicked off at the Beldih Club in Jamshedpur from 18th – 19th January.

The conference was inaugurated by Mr. Uttam Singh, Vice President, Iron Making, Tata Steel. This conference was organised by Tata Steel along with The Indian Institute of Metals (IIM), Jamshedpur Chapter and Pellet Manufacturers Association of India (PMAI).

The event focuses on innovations in process control and best practices in operational maintenance in sintering and pelletizing, along with challenges and opportunities for DRI grade pellets. It also emphasizes sustainable solutions in the area of energy and emissions.

The conference brings together around 250 participants representing over 50 leading global organisations providing an exclusive technical forum to discuss, deliberate, exchange and explore critical areas related to sintering and pelletization.

On first day of ICSP-2023, keynote and lectures were delivered by eminent professionals from the agglomeration industry and academia. On 19th January, four technical sessions containing 20 presentations from the participants were planned.

The Dignitaries are @ the dais

The Audience

****

Steel Statistics — World Crude Steel production

Crude Steel production by region (Dec)

	Dec 2022 (Mt)	% change Dec 22/21	Jan-Dec 2022 (Mt)	% change Jan-Dec 22/21
Africa	1.1	-8.9	14.9	-6.6
Asia and Oceania	104.9	-9.2	1,351.30	-2.3
EU (27)	9.2	-16.7	136.7	-10.5
Europe, Other	3.4	-19.2	44.7	-12.2
Middle East	3.7	0.4	44.0	7.1
North America	8.8	-9.9	111.4	-5.5
Russia & other CIS + Ukraine	6.2	-28.4	85.2	-20.2
South America	3.3	-3.8	43.3	-5.0
Total 64 countries	**140.7**	**-10.8**	**1,831.5**	**-4.3**

The 64 countries included in this table accounted for approximately 98% of total world crude steel production in 2021. Regions and countries covered by the table:

- **Africa:** Egypt, Libya, South Africa
- **Asia and Oceania:** Australia, China, India, Japan, New Zealand, Pakistan, South Korea, Taiwan (China), Vietnam
- **European Union (27)**
- **Europe, Other:** Bosnia-Herzegovina, Macedonia, Norway, Serbia, Turkey, United Kingdom
- **Middle East:** Iran, Qatar, Saudi Arabia, United Arab Emirates
- **North America:** Canada, Cuba, El Salvador, Guatemala, Mexico, United States
- Russia & other CIS + Ukraine: Belarus, Kazakhstan, Moldova, Russia, Ukraine, Uzbekistan
- **South America:** Argentina, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela

Top 10 steel-producing countries

	Dec 2022 (Mt)	% change Dec 22/21	Jan-Dec 2022 (Mt)	% change Jan-Dec 22/21
China	77.9	-9.8	1,013.0	-2.1
India	10.6	0.8	124.7	5.5
Japan	6.9	-13.1	89.2	-7.4
United States	6.5	-8.3	80.7	-5.9
Russia	5.5 e	-11.3	71.5	-7.2
South Korea	5.2	-11.6	65.9	-6.5
Germany	2.7	-14.6	36.8	-8.4
Türkiye	2.7	-20.0	35.1	-12.9
Brazil	2.5	-5.2	34.0	-5.8
Iran	2.7	3.3	30.6	8.0

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

Source : worldsteel.org

****

Total Production of Crude Steel in Last 2 Years

(million tonnes)

Country		2022	2021	%2022/2021
World		1878.5	1960.4	- 4.2
1	China	1 013.0	1 034.7	-2.1
2	India	124.7	118.2	5.5
3	Japan	89.2	96.3	-7.4
4	United States	80.7	85.8	-5.9
5	Russia (e)	71.5	77.0	-7.2
6	South Korea	65.9	70.4	-6.5
7	Germany	36.8	40.2	-8.4
8	Turkey	35.1	40.4	-12.9
9	Brazil	34.0	36.1	-5.8
10	Iran	30.6	28.3	8.0
11	Italy	21.6	24.4	-11.6
12	Taiwan, China (e)	20.6	23.2	-11.2
13	Viet Nam (e)	20.0	23.0	-13.1
14	Mexico	18.2	18.5	-1.6
15	Indonesia (e)	15.6	14.8	5.2
16	France	12.1	13.9	-13.1
17	Canada (e)	12.0	13.0	-7.8
18	Spain	11.5	14.2	-19.2
19	Malaysia (e)	10.0	9.1	10.0
20	Egypt	9.8	10.3	-4.6

Source : worldsteel.org