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New Launch IIM Materials Technology Start-up Award

The IIM Materials Technology Start-up Award was instituted by The Indian Institute of Metals in 2022 as one of the categories under 'IIM Awards' to commemorate the completion of the 75 years of the Indian Institute of Metals.

'Materials Technology Start-up' here refers to all start-ups in the field of metallurgy and materials engineering, established in India and recognized by DPIIT, GoI as a Start-up company.

IIM invites applications/nominations in offline mode for the second year in a row. The guidelines and the forms are available in IIM Award portal [https://www.nmd-iimawards.com & IIM Website [https://www.iim-india.net].

The maiden award for Materials Technology Start Up was conferred on M/s Amnivor Medicare Pvt. Ltd., Marishda, West Bengal during the IIM Awards Ceremony held on 14th November 2022 at Ramoji Film City, Hyderabad, glimpse of which is being shared here.

Amnivor Medicare Pvt Ltd at a glance:

Amnivor Medicare Pvt Ltd is formed with the idea of translating the knowledge from bench to bed side. The technology adopted under this organization was initiated under academia. However, under this start up, the large scale manufacturing was established and different value added products for utilization in wound care management were conceived through several breakthroughs and brain storming.

For collagen extraction, mostly bovine, pig and avian based resources are utilized globally. This restricts its wide scale acceptability and usage because of concerns of immunogenicity, disease transmission and religious barrier. Moreover, the extraction process is very costly, time consuming and involves a number of steps and chemical treatments as these sources contain high amount of non-collagen substances. Recently, aquatic origin is found to be an alternate collagen source.

Herein, Amnivor Medicare Private Limited (Amnivor) developed a process for extraction of collagen from bio-waste of fish market through efficient waste management and developed fish collagen based various down streams like wound dressings, 3D matrices for cell expansion, Hemostat, Dental solutions. The efficacy of these products has been validated in vitro and in vivo (mice model). In vivo studies have been found to be promising and outcome is comparable with the existing advanced wound care products.

A proprietary method of collagen in combination with biopolymers has been developed for efficient and accelerated healing of different types of wounds and recovery of damaged tissue. The developed wound dressings have been designed into different forms and therefore could be easily applied to any shape and size of wound including irregular/deep and exudating/dry wounds.

Dr. Santanu Dhara, Director of Amnivor Medicare Pvt. Ltd. (Middle) being felicitated by the Vice Presidents of IIM, Mr. Satish Pai and Prof. BS Murty.

Technical Article

Effect of Indium addition on the mechanical properties of Cu-Ga alloy

Rakesh Das[1], Abhijit Chhotray[2], Abhay Gautam[2], Manas Paliwal[1]* and Chandra Sekhar Tiwary[1]*

Abstract

Copper (Cu) and their alloys are gaining more popularity due to its higher electrical/thermal conductivity and tunable mechanical properties. The present work deals with an elaborate study regarding Cu-Ga alloy and the effect of Indium addition on the microstructure and mechanical properties. Cu-Ga and Cu-Ga-In alloys were characterized by optical, scanning electron microscope and transmission electron microscopy. Thermodynamic assessment was performed by Factsage to determine the composition and explain solidification pathways. The results of the solidification simulations are in an agreement with the experimental observations. It was found that the addition of In to the Cu-Ga has a significant effect on its structure and mechanical properties of the ternary Cu-Ga-In.

Keywords: *Thermodynamic calculations, Microscopy, Intermetallic, mechanical properties, Cu alloys*

1. Introduction

Copper (Cu) and Gallium (Ga) finds widespread acclamation in interconnects industry due to its low melting point, non-toxicity, good wettability. Ga forms high temperature stable solid solutions and intermetallic compounds (IMCs) with other metals such as Cu, Ni and Al. Ga has higher solubility in FCC Cu, so there is more probability of formation of IMCs over a wide temperature range[1]. Microelectronic components have significantly reduced its size in recent years and performing well with minimum impact on environment and human life. Alloys with low melting point have significant potential that can be tailored to achieve unique combinations of electrical and thermal conductivity. Previously used Hg, Pb and its derivative alloys have been banned in electronic application due to its toxic property. Ga has a wide temperature range as its melting and boiling temperatures are 29.76 °C and 2403 °C respectively. Indium (In) has good ductility and a primary candidate in electronic applications. The research on eutectic Ga-In and Ga-In-Sn led these alloys to be used in micro-electronic devices for their unprecedented properties. Ga is also used in soldering industry and research has been carried out on Cu-substrate to observe and analyse the solderability and strength of interface [2,3]. A new type of metallic glue of Ga-In has been developed which can be employed at room temperature with application of pressure. The bond achieved is as strong as metallurgical bond and can be used as a joining technique in microelectronic packaging industry[4]. The reaction and interaction between Cu and Ga based alloy remain the main research area for several years. Investigations have shown that during the reaction of Cu-rich Cu-Ga system,

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$CuGa_2$ is the single phase which form at room temperature. To check the interfacial region of Cu-Ga, Ga/Cu couples have been exposed at 200 °C for different durations varying from 3 to 48 hrs. It was found that first θ-$CuGa_2$ phase forms and with increment of time, Cu_9Ga_4 phase gets evolved. Formation of θ-$CuGa_2$ reduced the joint strength, but with Cu_9Ga_4 shear strength was improved[3]. $CuGa_2$ shows remarkably high electrical and thermal conductivity than compared to GaIn[5]. It has been found that $CuGa_2$ and Cu_9Ga_4 plays a crucial role in mechanical strength [3]. Intermetallic compounds such as Ti_3Al and Ni_3Al have shown unprecedented properties to be used in high temperature application to sustain its physical and mechanical properties [6–8]. In intermetallics, defects such as dislocations tend to move in pairs or groups thus their motion is inhibited at elevated temperature. The brittle nature of intermetallics has been attributed to the small number of activated slip systems and to the grain boundary weakness. One of the limiting factors for intermetallic is the lower fracture toughness Intermetallics also exhibit higher ordered structure for which diffusivity decreases. There are variety of strengthening mechanisms which contribute to enhanced strength of materials: these include solid solution strengthening [9], precipitation hardening [10], dispersion strengthening [11], grain boundary strengthening[12] and work hardening [13]. Hardening in intermetallics is mainly attributed to solid solution hardening, order hardening, second phase hardening and grain boundary strengthening [14].

Intermetallic plays a crucial role in Cu-based alloy for e.g., in Cu-Sn binary alloy, Cu_6Sn_5 is the primary intermetallic which have been investigated extensively [15]. For Cu-based alloys the stability of different phases at different temperature depends upon conduction electron per atom (e/a ratio) [16]. Das *et al*. [17] have studied the effect of gallium in the Cu-In binary system and have reported the mechanism of liquid reinforcement in Cu-Ga-In alloy system. There is no literature available regarding the effect of In addition to the Cu-Ga binary system. Ga has an electrical conductivity of 6.76×10^6 W/m/K and thermal expansion coefficient is closer to that of Cu [18]. Cu-Ga binary system contain many intermetallic phases. One of the major phases which is formed in Cu-Ga binary system is Cu_9Ga_4, which has a cubic structure (a=8.73Å). The Cu-Ga system has been thermodynamically assessed by Li *et al.* [19] and they have reported that four electron compounds with γ-brass like structure in the region 29.5-42.6 at% Ga. They have also mentioned order-disorder transformation in between two electron compounds (γ_0 and γ_1). γ_0 and γ_1 have the same crystal structure $D8_3$ with space group $P\bar{4}3m$ [20]. The Cu-Ga-In alloy system has been studied by Muzzillo *et al.* [21]. They have evaluated the Gibb's energy of the Cu-Ga-In ternary solid solution by referring Cu-Ga [19], Ga-In [22] and Cu-In [23] binary alloy systems. The lattice structure of Cu_9Ga_4 [24] and Cu_9In_4 [25] has been given in **Fig. 1.** Cu-Ga system possess unique properties in these areas and can be exploited as interconnect for microelectronic devices. Cu-Ga-In system has been studied with respect to its application in photovoltaic application by alloying with selenium [26]. By continuing the observation of Das *et al.*, [17] Cu-Ga binary alloy system and the effect of indium addition on the mechanical and electrical conductivity have been investigated.

2. Experimental details

The compositions were calculated from the thermodynamic assessment and the respective compositions were converted to weight fraction from atomic percentage. For this experiment two sets of alloy systems have been prepared one is binary and another with a ternary composition. These two sets of alloys have been prepared by

taking predetermined compositions mentioned in **Table 1** of Cu (99.9% purity), In (99.9%) purity and Ga (99.9% purity) in a quartz crucible and melted in an induction furnace in an argon purging environment. The maximum temperature was 1100 °C and kept at this temperature for 5 minutes for homogenizing the samples. The samples were renamed OD1 and OD2 per convenience. To get the required phases, normalizing of the OD1 and OD2 have been performed by putting the samples in a vacuum sealed quartz tube and keeping the quartz inside a muffle furnace. The temperature chosen for the OD1 and OD2 were 600 °C and 550 °C respectively for a time period of 168hrs. The targeted and SEM-EDS analysis compositions have been listed in **Table 1**. *Ecomet-3000* variable speed grinder polisher was used to polish the samples using silicon carbide emery paper. Optical analysis was performed using *Leica-DM2500M* and compositional conformation was assessed through SEM-EDS. For phase analysis, *Bruker D8 Advance with Lynx eye detector* was used using Cu-Kα radiation (λ=0.15418 nm). For the diffraction patterns the goniometer angle was set from 20° to 100°. The phase analysis was confirmed using EVA Software. For compression test, the samples were prepared in cylindrical form, according to ASTM E09-09[27], from the heat-treated samples using an Electrical discharge machining (EDM) cutting machine. A uniaxial compression testing machine (*UTM Instron Model 3365*) was used for compression test at room temperature with a strain rate of 0.1mm/min. The fracture surface of the compression tested samples were analysed using SEM (*Jeol JSM-IT300HR*) to ascertain the fracture mechanism. The Hardness test was performed using UHL VMHT MOT micro-Vickers hardness tester having a diamond pyramid indentor. The load was fixed at 15 gf and the dwelling time was set for 15 s. For tribological study, ball-on disk Anton Paar Tribometer was used to analyse the penetration depth and coefficient of friction. The ball was made of tungsten carbide (WC) and the ball movement was set in a back-and-forth motion with a frequency rate of 10Hz. Wear analysis was performed under a load of 10 N at room temperature for 900 s. Indentation Fracture toughness (IFT) measurement was carried out by taking the indentation at varying load and measuring the crack tip growth at the corner of indentation in OD1 and OD2. Fracture toughness has been evaluated from the hardness indentation using the following equation: $K_i = 0.0123\ (E)^{0.4}\ (H)^{0.1}\ (P/l)^{0.5}$, here 'E' is the Young's modulous, 'H' is the hardness, 'P' is the load applied during indentation and 'l' is the length of the crack from the corners of micro-Vickers indentation [28]. For TEM analysis, *FEI Titan Themis 60* with a capacity of 300kV was used, thin foils from OD1 and OD2 were prepared and foils were cleaned in plasma cleaner in H_2 and O_2 plasma mode for 5min.

3. Results & Discussion

The representative binary Cu-Ga phase diagram and liquidus projection of ternary Cu-Ga-In system are given in **Fig. 2(a)-(b)** respectively. The red circle marks in the ternary diagram shown in **Fig. 2(b)** indicate the investigated binary and ternary compositions for the current study. All thermodynamic calculations in the present work were done using Factsage software [29]. According to thermodynamic assessment, the first phase form in OD1 is the G0 and for OD2 is the Gamma (γ) phase. G0 is the- Cu_9Ga_4 and γ phase is $Cu_9(Ga,In)_4$. The Gulliver-Scheil cooling curve represents the phases formed in succession during cooling. The first phase form is γ and then ETA-HT for the ternary OD2. The XRD pattern of the heat-treated samples are given in **Fig. 3(a)**. The difference in 2θ peak position can be clearly visualized in both OD1 and OD2. All the peaks OD1 correspond to Cu_9Ga_4 after equilibration. The lattice constant measured from the diffractogram was 8.75Å for ordered OD1 and it can be concluded that the lattice parameter is same as that given in

JCPDS (#04-006-8938). The ternary OD2 contains a mixed intermetallic phase of $Cu_9(Ga,In)_4$ and Cu_7In_3. So, there is an agreement between thermodynamic analysis and XRD analysis of the investigated samples. The heat treated optical and SEM microstructures of OD1 and OD2 are shown in **Fig. 2(b)**. Area Mapping of the alloys were conducted to observe the distribution of alloying elements and findings are shown in **Fig. 4.** The compositions of the investigated samples are quantitatively similar as per the EDS analysis. The Cu, Ga and In alloy shows homogeneous distribution throughout the surface in both samples. From the Optical and SEM analysis it can be corroborated that the equilibrated OD1 and OD2 composed of only one phase. From the EDS it is evident that the whole surface is comprised of a solution of Cu, Ga in OD1 and a mixed solid solution of Cu, Ga, In for the OD2 respectively. It is evident from the mapping that segregation is not present in the samples due to the heat-treatment. **Figure 5** shows the TEM micrographs OD1 and OD2 alloys. Electron diffraction pattern reveals the BCC structure of both OD1 and OD2. SAED for OD1 across $[\bar{1}11]$ and $[1\bar{1}1]$ zone axis exhibits two different spot intensities in a regular array manner which is the indication of superlattice structure. But the difference in intensities of the spots in the case of OD2 is small which may be due to the addition of *In* in the case of OD2. Intensities varies in a SAED pattern depending upon the structure factor which is related to the atomic scattering factor exhibited by each atom present in the unit cell. For OD1, the difference of atomic scattering factor between Cu and Ga is high. But in the case of OD2, the addition of In atom decreasing the difference in atomic scattering factor. Owing to this there is marginal difference in intensities of spot when compared to OD2. From the TEM micrographs, the interplanar spacing along [111] direction is determined to be 0.198nm for both ordered OD1 and disordered OD2. The micro-Vickers hardness test results has been shown in **Fig. 6(a)**. OD2 exhibits hardness of 689.5 Hv and that of OD1 have 583.6 Hv. In OD2, there exist two intermetallic as indicated by the XRD analysis. Both these phases are contributing to the higher hardness value in OD2 as compared to that of OD1. Addition of In is also acting as a solute hardening site where it is generating more stress around the atoms while accommodating itself inside the solution. To determine mechanical properties, the stress-strain plot of the compression plot of the heat-treated samples OD1 and OD2 have been shown in **Fig. 6(b)**. It is apparent from the plot is that both ordered OD1 and disordered OD2 demonstrating brittle behaviour up to fracture. This brittle nature of these two alloys were also confirmed during compression of these two alloys as bursting of tested samples happened. From the graph, it is revealed that OD2 is showing slightly higher elastic modulous than that of OD1 and also OD2 displays higher amount of toughness than OD1 prior to fracture. The Ultimate Tensile Strength (UTS) has been measured from the stress-strain compression data and plotted in **Fig. 6(c)**. The reason behind this distinct behaviour may be attributed to the intermetallic present inside the tested sample. As mentioned before, OD2 contain two type of phases and the fraction and interface interaction may lead to the higher toughness, yield strength and UTS to the OD2 heat treated sample during compression. SEM fractographs of the compression tested OD1 and OD2 have shown in **Fig. 6(g)** & **(h)** respectively. Fractographs of OD1 and OD2 demonstrate the brittle nature of the surface during compression owing to presence of facets which is a characteristic of brittle fracture. The Tribological tests were performed at ambient temperature and the results of penetration depth and co-efficient of friction are shown in **Fig. 6(d)** & **(e)**. The penetration depth is generally related to the hardness of material. As Hardness increases, the penetration depth decreases. But in these heat-treated OD1 and OD2, there is a discrepancy

between hardness and penetration value when comparing **Fig. 6(a)** and **6(d)**. For the case of OD2, it is showing higher penetration depth than OD1 as time progresses. Fracture toughness is a unique and most required property of a material as it characterizes materials brittleness or resistance to fracture. Indentation fracture toughness measurement plot have been calculated from micro-Vicker's hardness and is given in **Fig. 6(f)**. Addition of In to the Cu-Ga system is enhancing the fracture toughness as clearly visible in the plot. Indentation fraction toughness of OD1 and OD2 have been evaluated by indenting both the sample with increasing load. The cracks generated during the indentation in the heat-treated sample has been processed through ImageJ software and crack length has been calculated. OD2 is exhibiting higher fracture toughness than OD1. The brittleness and lower strength of ordered alloy in this study may be attributed to mainly two reasons either insufficient number of slip system or grain boundary weakness. But the disordered ternary alloy shows higher strength than the ordered alloy. Here grain boundary plays a crucial role in accumulating the dislocation at the vicinity of grain boundary.

4. Conclusions

The thermodynamic calculation has predicted optimum single composition in both Cu-Ga and Cu-Ga-In system. The melted and homogenized alloys show single phase microstructure. It is found that addition of In to the Cu-Ga system has improved mechanical properties. There is no significant change in microstructure with both OD1 (Cu-Ga) and OD2(Cu-Ga-In). The OD2 exhibits higher hardness than OD1. OD2 alloy has a higher yield strength in comparison to OD1 alloy. Fracture toughness shows an increment with the addition of In.

Declarations

Conflict of interest No potential conflict of interest was reported by the authors.

Table 1 : Composition for OD1 and OD2 assessed through thermodynamic calculation.

Element	OD1	OD2
	At. %	At. %
Cu	67.4	66.5
Ga	32.6	16.1
In	-	17.4

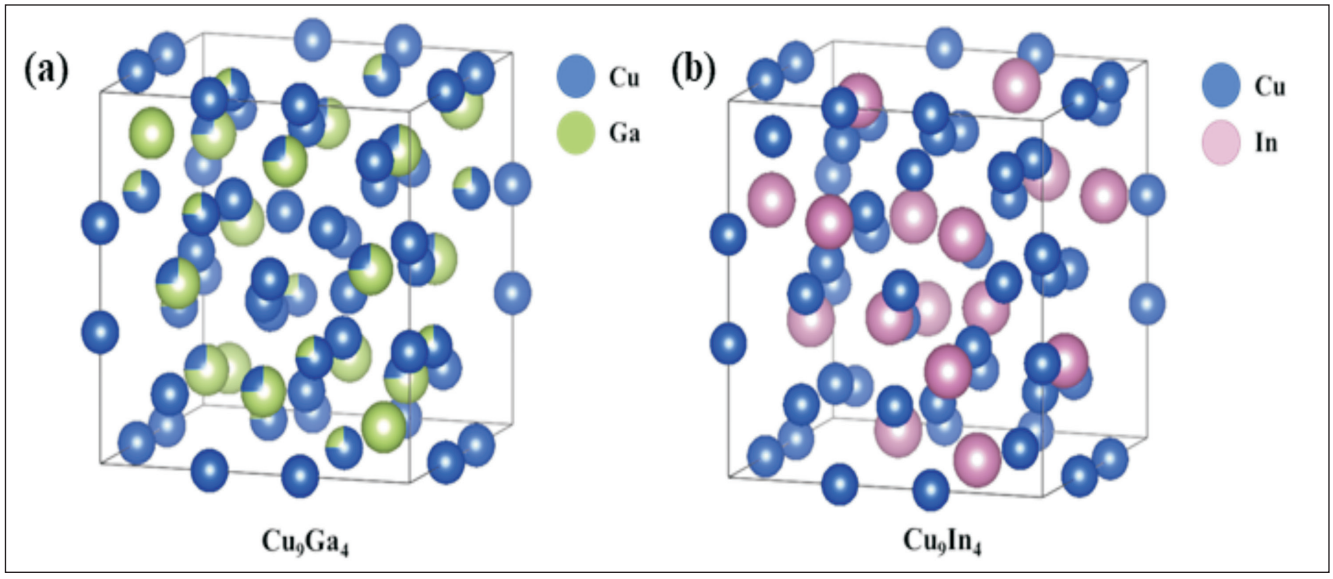

Fig. 1 : Crystal structure of (a) Cu_9Ga_4 and (b) Cu_9In_4 showing the atom positions of Cu, Ga and In.

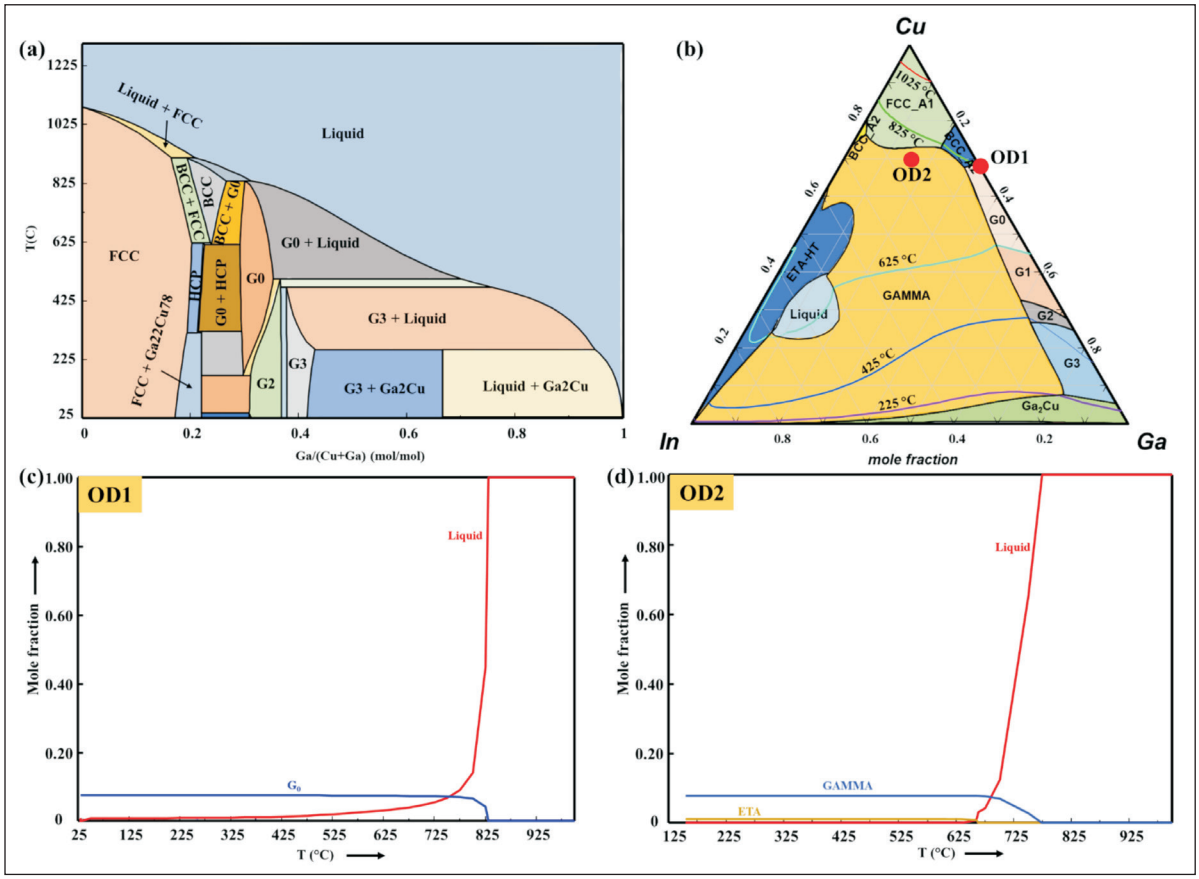

Fig. 2 : (a) Phase diagram of Cu-Ga binary system, (b) The liquidus projection in the Cu-Ga-In ternary system determined in this study. The two red circle marks correspond to the investigated binary OD1 and ternary OD2 respectively, (c)-(d) phase fraction of different phases in OD1 and OD2 respectively during non-equilibrium cooling through Factsage software.

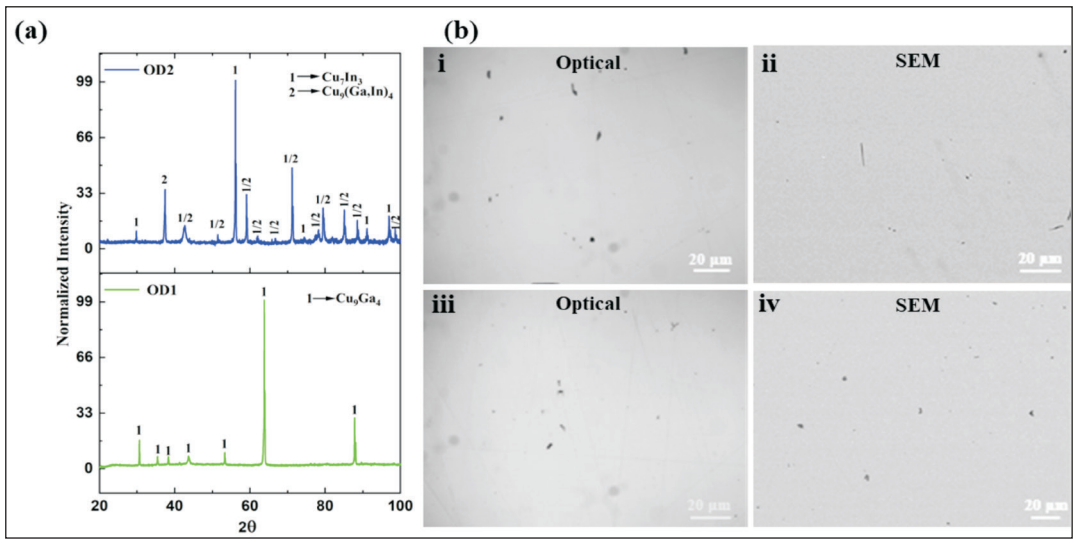

Fig. 3 : (a) X-ray diffractogram of ordered OD1 and disordered OD2 obtained at room temperature, (b) Optical (i) and SEM (ii) micrographs of ordered OD1, Optical (iii) and SEM (iv) micrographs of disordered OD2.

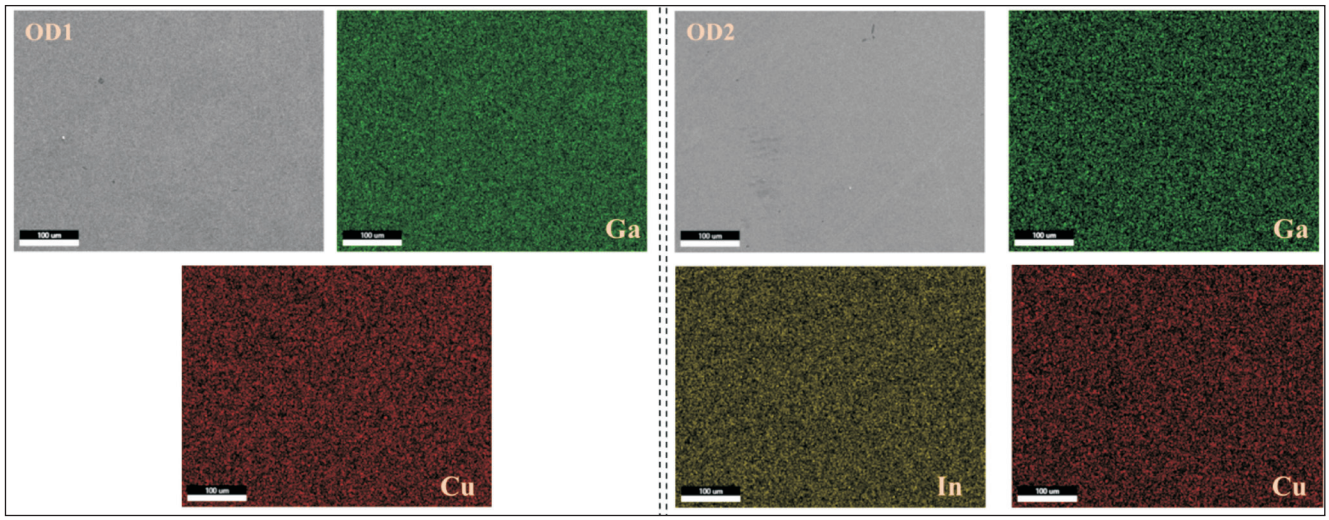

Fig. 4 : Representative SEM image of equilibrated OD1 And OD2 and corresponding area mapping.

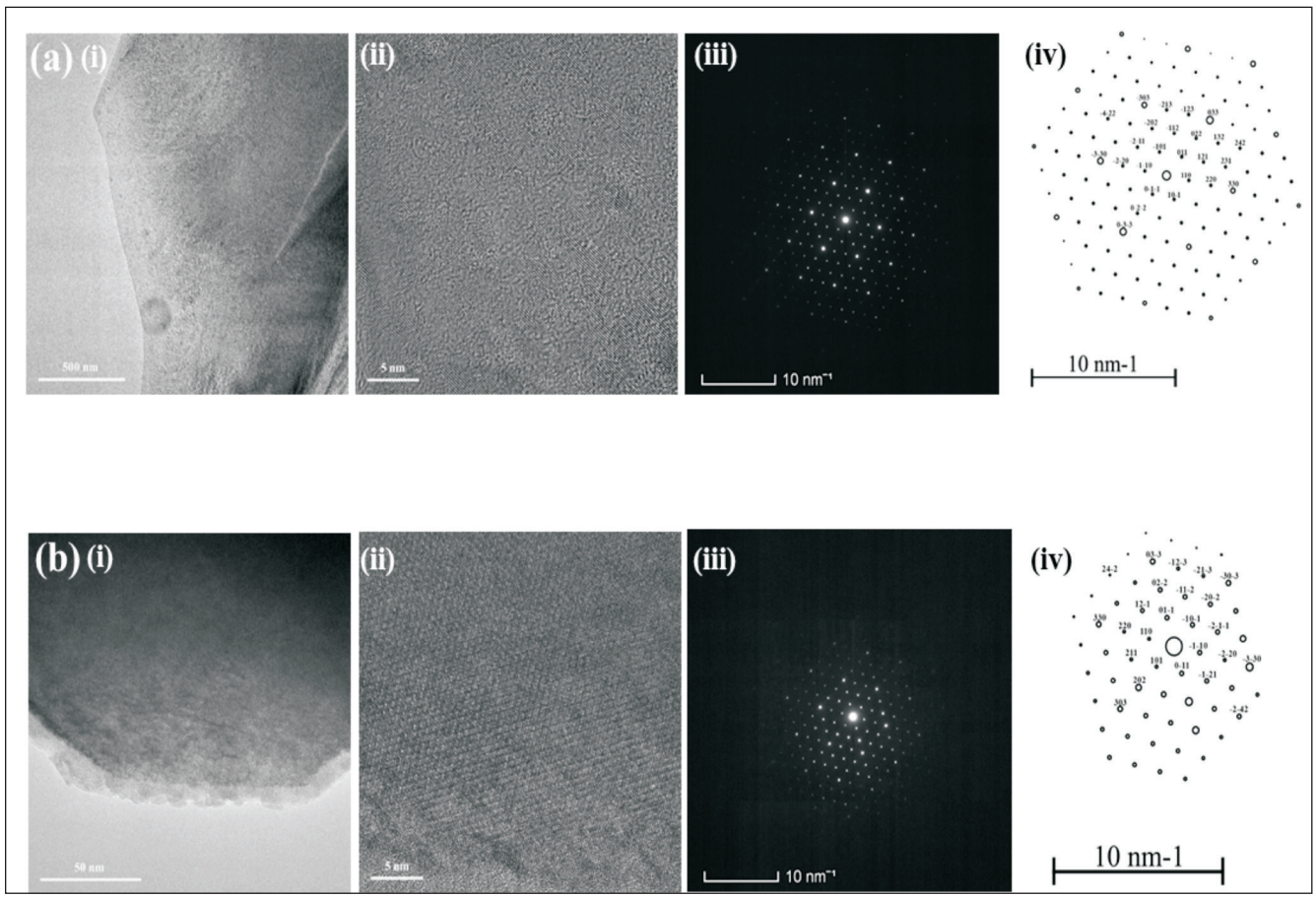

Fig. 5 : (a) TEM micrographs (i)-(ii) of ordered OD1 and (iii-iv)) corresponding electron diffraction pattern and simulated electron diffraction pattern along [1 1] direction, (b) TEM micrographs (i)-(ii) of disordered OD2 and (iii-iv) corresponding electron diffraction pattern and simulated electron diffraction pattern along [ ] direction.

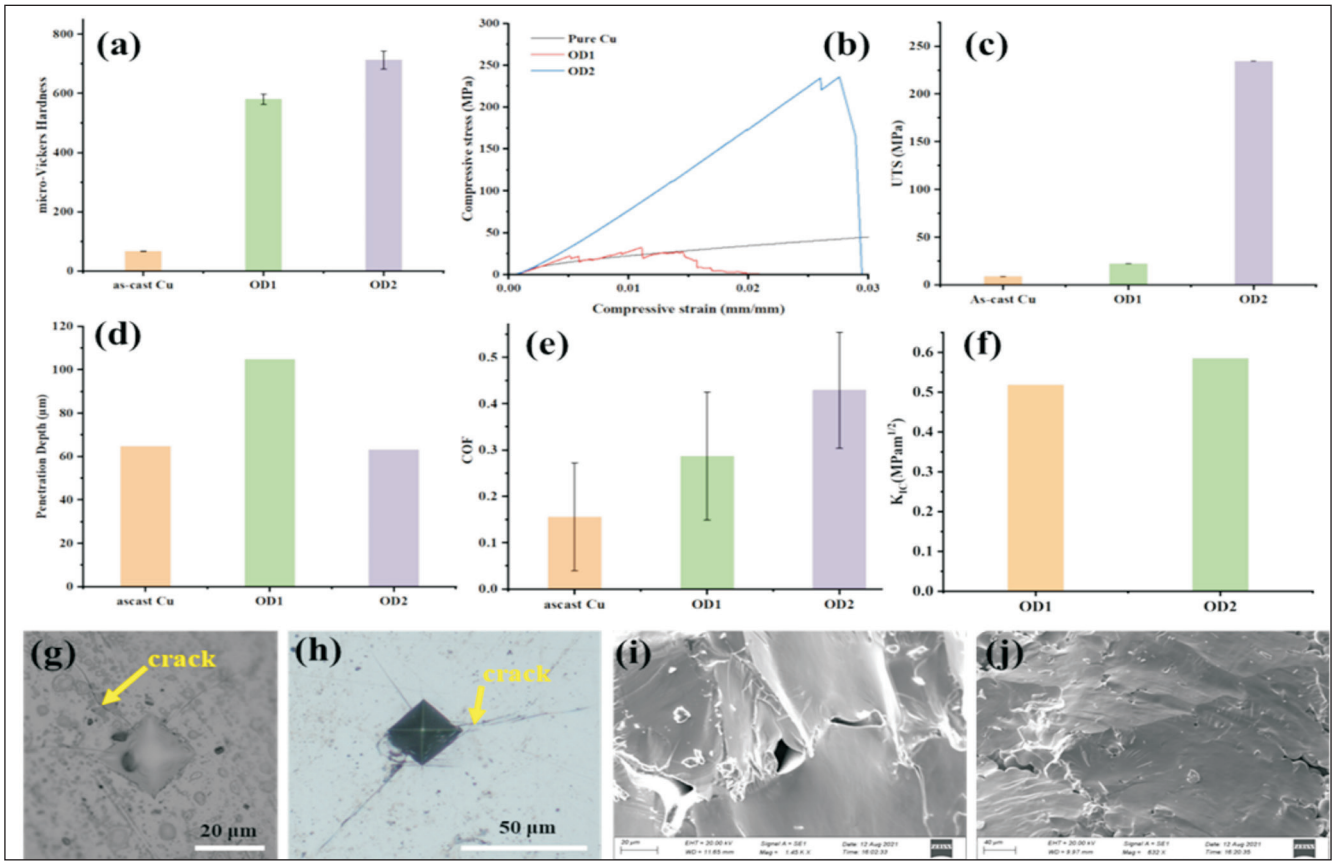

Fig. 6 : (a) micro-Vickers hardness at a load of 15gf, (b) Compression test at room temperature, (c) Ultimate tensile test plot of equilibrated OD1 and OD2 with as-cast Cu, (d) Penetration depth analysis plot, (e) coefficient of friction, (f) indentation fracture toughness determination from micro-Vickers hardness test, (g-h) optical images of corresponding indent with crack initiation at the corner of indent of OD1 and OD2 respectively, (i-j) SEM fracture surface images of equilibrated OD1 and OD2 respectively.

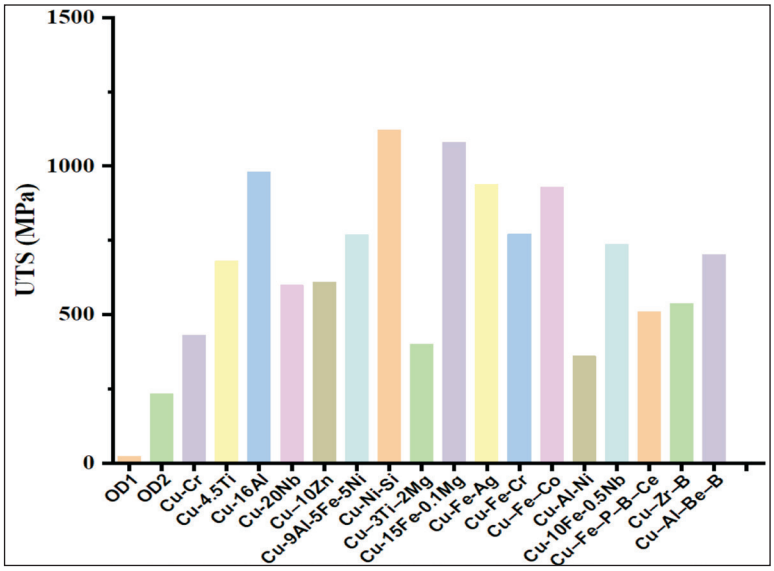

Fig. 7 : UTS comparison of OD1 and OD2 with previously reported Cu-based alloys [30]–[46].

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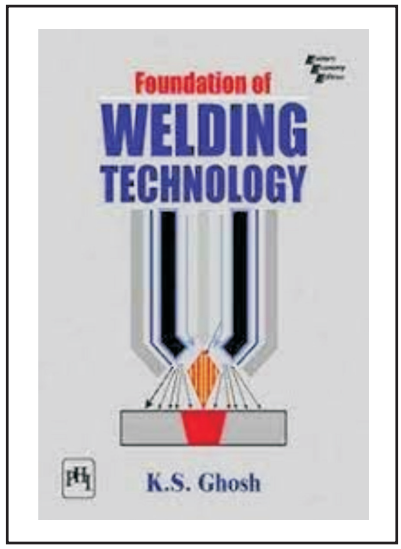
Book Review

Foundation of welding technology by Ghosh, K.S.



Dr. K.S. Ghosh is currently serving as a Professor in the Department of Metallurgical and Materials Engineering, National Institute of Technology (NIT), Durgapur.

Book is available both in print and E-book forms. Print Book ISBN : 9789391818029, eBook ISBN : 9789391818074, E-book Price- Rs.671.25

Brief Summary

Foundation of Welding Technology presents the fundamental and advanced analysis of welding metallurgy and technology in clear, simple, and lucid language. The book explains the welding fundamentals, various welding processes, flux formulation of SMAW electrode, heat flow in welding, welding metallurgy of steel and stainless steel and non-ferrous alloys (Al-base, Cu-base, Ti-base, and Mg-base) and dissimilar metals and alloys, hard facing techniques, welding defects and residual stress, brazing and soldering and weld inspection and testing, etc. in detail in very systematic and logical manner. A large number of illustrative numerical problems have been included throughout the book as an aid to the students. The MCQs and Numerical Problems will definitely be helpful to the aspirants of GATE, ISE/ESE, and other examinations. This book is especially designed for diploma, undergraduate and postgraduate students of Mechanical, Production, and Metallurgical and Materials Engineering.

Key Features of the book consists of (i) Easy-to-read style and simple and logical explanation of Welding Fundamentals (ii) numerous numerical problems as examples with solutions and exercises with answers, (iii) a large number of multiple-choice questions (MCQs) to help GATE/ISE/ESE aspirants, (iv) manufacturing of the welding electrodes and (v) basic discussion of a relatively new, friction stir welding (FSW) process.

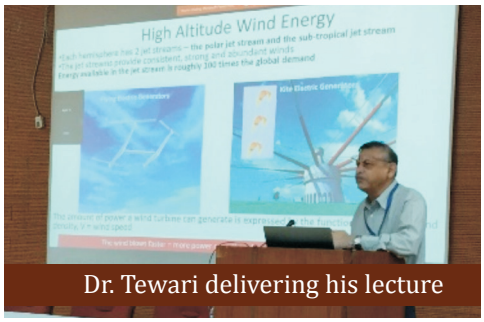
This book is composed of various chapters, and covers Welding in General, Gas Welding Process, Arc Welding, Shielded Metal Arc Welding (SMAW), Metal Inert Gas (MIG) Welding, Gas Tungsten Arc Welding (GTAW), Submerged Arc Welding (SAW), Plasma Arc Welding, Electroslag Welding, Resistance Welding, Electron Beam Welding (EBW), LASER Beam Welding (LBW), Friction Stir Welding (FSW), Solid State Welding, Thermit Welding, Heat Flow in Welding, Welding Metallurgy of Steel, Weldability of Stainless Steels, Cast Irons and Non-ferrous Alloys, Welding Defects and Cracking and Residual Stress, Weld Hard facing, Brazing and Soldering, Weld Testing and Inspection.

Chapter Activities

Mumbai, Hazira, Visakhapatnam, Rourkela, Kharagpur, Pune

Mumbai Chapter

The Mumbai Chapter of the Indian Institute of Metals organised a technical talk in December 2022 as a part of its monthly lecture series featuring leading experts in metallurgy and related fields. The lecture was delivered by Dr. Ragvendra Tewari, Associate Director, Materials Group, BARC and Vice Chairman, IIM Mumbai Chapter. The title of the talk was "Energy Scenario in the Country and Changing Role of Nuclear Energy". The event took place at the Training School Hostel's multipurpose hall in Anushaktinagar, Mumbai. The event was attended by over 100 people in person and an additional 50 through online. The lecture provided insightful perspectives on the current and future energy scenario in India. After the talk, Dr. D. K. Singh, Secretary, IIM Mumbai Chapter, thanked for his informative presentation on the future energy demands of the country.



Dr. Tewari delivering his lecture

The participants interacting with the Speaker

Hazira Chapter

IIM Hazira Chapter organised a membership drive at Sardar Vallabhbhai Patel Institute of National Technology (SVNIT), Surat on 13.01.2023. The benefits of IIM membership was explained to around 40 potential participants (Mix of Industry professionals, Academics and students) by the representatives of IIM Hazira Chapter. During the presentation, newly launched IIM flyers were also circulated to the attendees for retention of information. The chapter had also arranged to have a registration desk at the event for facilitating "on the spot" registrations. The event was successful in creating awareness about IIM and its membership benefits amongst the audience.

@the event on IIM membership drive @SVNIT

Visakhapatnam Chapter

A membership drive was conducted by IIM Visakhapatnam Chapter on 19th January, 2023 at Government Polytechnic Visakhapatnam. Shri G.V.V. Satyanarana Murty, Principal, Government Polytechnic Visakhapatnam, and Dr. K Ratna Kumar, HOD of Metallurgy Dept. Government Polytechnic Visakhapatnam along with other faculties and more than 50 students attended the program. Chapter Secretary Shri Lalan Kumar delivered a talk about IIM, the benefits of its membership and guidelines for student affiliate chapter. He spoke about various initiatives taken by the Visakhapatnam Chapter in the past to improve student interaction with industries and also on future plans. Students have shown their keen interest in visiting steel plant and taking part in technical seminars. Hon. Treasurer, Visakhapatnam Chapter Shri Mahesh Kumar Sharma talked about different categories of IIM memberships.

Membership Drive @ Visakhapatnam


Membership Drive @ Visakhapatnam

Rourkela Chapter

The Indian Institute of Metals Rourkela Student Chapter organised a technical event "SCIENCE SAFARI" on 5th February 2023. Prof. Anshuman Patra, Faculty Advisor, IIM Rourkela Student Chapter, Prof. Rajesh Kumar Prusty, Jt. Secretary, IIM Rourkela Chapter, Prof. Ajit Behera, Jt. Treasurer, IIM Rourkela Chapter were the coordinators of the event. The Student Chapter committee involving Mr. Arka Ghosh, Mr. Nityananda Sahoo, Mr. Enamul Hussain Khan significantly contributed to the successful completion of the event. Prof. Anindya Basu, Head of the Department of Metallurgical and Materials

Glimpse of the Rourkela Chapter event "SCIENCE SAFARI"

Engineering, NIT Rourkela delivered the inaugural talk and emphasised the importance of materials in modern days. Around 28 school students from Rourkela demonstrated different science models at the event. Prof. Debasis Chaira and Prof. Krishna Dutta, Department Metallurgical and Materials Engineering Department, NIT Rourkela, were the evaluators of the event. Prof. Anshuman Patra presented the Vote of Thanks.

Kharagpur Chapter

A seminar on "Optimising EBSD mapping and post-processing, tips, tricks, and latest innovations" was organised by IIM Kharagpur Chapter, in association with Department of Metallurgical and Materials Engineering, IIT Kharagpur and Central Research Facility, IIT Kharagpur on 6th February, 2023 at 11:00 am. Dr René de Kloe was the key speaker of the event. He has been working as applications specialist for electron back scattered diffraction (EBSD) and later also energy dispersive spectroscopy (EDS) at the EDAX European support office in Tilburg, The Netherlands since 2001. In his presentation, he discussed the effects of camera, indexing, and mapping settings on the final EBSD results and introduced the latest innovations in orientation image map analysis. The seminar was attended by more than 75 faculty members and research scholars.

Pune Chapter

1) Workshop on Surface Engineering :

A one-day workshop on "Surface Engineering" was organised by IIM Pune chapter in association with Department of Mechanical Engineering, Sandip Institute of Engineering and Management, Nashik on 10th February 2023 at Nashik. The workshop was very informative, knowledgeable and an eye opener for the industrial professionals, academicians, and student participants. Prof Sachin Chede, Convenor, briefed the purpose of the workshop. Dr. N B Dhokey welcomed the participants and introduce IIM Pune chapter. Dr. D Patil, Principal, addressed the august gatherings and Dr. Dubey, HoD (Mech Engg) explained the role of professional bodies in

@ the Workshop on 10th February 2023

networking with educational institutions. Around 60 participants attended the workshop. Most of the participants were from Industries and few are from different Institutes. The event was generously supported by Matrix Testing Machine Services (Calibration Division) and Spraymet Banglore. The distinguished speaker list include Dr. Umesh Mhatre Managing Director, Surface Modification Technologies, Dr. D. A. Karandikar, CEO / CTO Kinetic Surface Technologies, Pune; Prof. Dr. N B Dhokey Professor, Department of Metallurgy, COEP Tech; Dr Rajesh Bhide, Head of Customer Solutions Centre, India and Associated Countries Oerlikon Balzers Coating India Pvt. Ltd., Pune; and Mr. Jaywant Nagrale Manager Metallography, Chemical and Failure analysis lab Bosch India Ltd., Nashik.

2) Invite lecture by Stephen James Booth on High Pressure Cold Spray :

IIM Pune chapter organised an online talk on 21st February 2023. The key speaker of the talk was Mr. Stephen James Booth, Technical Director Thermal Spray Engineering, Bexxon Global Pte Ltd, Singapore. The topic of the presentation was "High Pressure Cold Spray". The presentation covered various industrial application of solid-state thermal spray process such as chrome replacement, corrosion repair, weld protection overlay, shaft repair, steel and cast-iron repair, and active leak repair for various industries such as aerospace, defense, shipping, power generation, heavy industry, mining, oil and gas, electronics, and industrial manufacturing. He also highlighted some of the key benefits related to this technology in terms of cost savings, reduced machine downtime, improved sustainability, and enhanced structural properties.

3) Invited talk by Prof. B. S. Murty, Director IIT Hyderabad, Vice President IIM on High Entropy Alloys – Opportunities and Challenges: IIM Pune chapter was delighted to host Prof. B S Murty for an invited lecture on 25th February at COEP Technical university, Pune. In his lecture, he covered two aspects: (i) highlights on the structural transformation he and his team have brought at IIT Hyderabad in terms of academic curriculum and industry connect (ii) Technical presentation on High Entropy alloys covering opportunities & challenges. It was attended by around 50 people from Industry, academia, R&D Institute and students. Prof. N. B. Dhokey briefed on the development happened at COEP and IIM activities. Mr. Lalit Pahwa, chapter chairman, provided concluding remarks and vote of thanks. Following the lecture, the Pune chapter EC members had a luncheon meeting with Prof. Murty. The focus of the meeting was on ways to make IIM more effective, increasing participation, membership enrolment and chapter's presence outside India.

Glimpse of the Pune Chapter event on 25th February

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Non-Ferrous Metals Statistics Domestic Scenario

Production (unit : Lakh Tonnes)

	Dec'22	Nov'22	Oct'22	2021 - 22	2020 - 21
ALUMINIUM					
National Aluminium Co Ltd	**0.39**	**0.37**	**0.38**	**4.60**	**4.18**
Hindalco Industries Ltd*	**0.49**	**1.09**	**1.13**	**12.94**	**12.28**
Bharat Aluminium Co. Ltd	**1.13**	**0.46**	**0.47**	**5.80**	**5.68**
Vedanta Ltd	**1.45**	**1.39**	**1.43**	**16.78**	**13.72**
TOTAL	**3.46**	**3.31**	**3.41**	**40.12**	**35.86**
*Renukoot, Hirakund, Mahan, Aditya					
ZINC (One major producer)					
Hindustan Zinc Ltd	**0.68**	**0.73**	**0.70**	**7.76**	**7.15**
COPPER (Cathode)					
Hindustan Copper Ltd	**0.000034**	**0**	**0**	**0.62**	**Nil**
Hindalco (Birla Copper)	**0.35**	**0.35**	**0.34**	**3.95**	**2.89**
Vedanta Ltd.	**0.13**	**0.09**	**0.11**	**1.37**	**1.118**
TOTAL	**0.48**	**0.44**	**0.45**	**5.94**	**4.008**
LEAD					
Hindustan Zinc Ltd	**0.15**	**0.16**	**0.16**	**1.91**	**2.14**

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

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

Seminars & Conferences

National Seminar on Demystifying Industry 4.0

As a part of the yearlong programme on "Demystifying Industry 4.0", the National Seminar, organised by Kolkata Chapter of The Indian Institute of Metals, Calcutta Regional Centre of Indian Institute of Chemical Engineers and Jadavpur University, was successfully organised at Hotel Pride Plaza, New Town, Kolkata on January 6, 2023.

The Inauguration Program of the seminar started with the invocation song "Saraswati Vandana", by Ms. Barnali Kar, Visiting Professor, Electrical & Power Engineering, Jadavpur University. Sri. Abhijit Mitra, Chairman, Calcutta Regional Centre, Indian Institute of Chemical Engineers, welcomed the gathering. Guest of Honour, Dr. A.R. Ghosal, Director, DCPL briefly presented the context of the seminar and its purpose.

Guest of Honour, Mr. D.C. Pant, Executive Director & Basin Manager, ONGC explained to the audience the steps that ONGC has undertaken to meet the global challenges in this sector and how the current changes in technology landscape has influenced its functioning.

Guest of Honour, Mr. Sanjay Agarwal, Executive Director (Marketing), SAIL shared his more than three decades of journey in SAIL, in various assignments including Production, Communication, Strategic Planning, Sales, Logistics, Corporate functioning, Retail & Marketing etc. He stressed on the adoption of the right technology for the right purpose in Indian Context.

Guest of Honour, Mr. Aloke Mukherjee, Former Chairman, Flakt India, Former President, BCCI and Former Chairman, CII (Eastern Region), traced the genesis of the 4th Industrial Revolution initiated in Germany and now across the globe. He emphasized on the threats and opportunities on employment, productivity, quality, cost of production and waste management.

Mr. B.P.Singh, Director In-charge (ISP, DSP & ASP, SAIL) and Chief Guest of the program, unfortunately could not attend the program in person due to personal bereavement. Mr. Abhik De, Chief General Manager, ISP, SAIL read out the address of Mr. Singh. In his address, Mr. B.P.Singh quoted John Chambers of Cisco, "At least 40% of all businesses will die in the next 10 years… if they don't figure out how to change their entire company to accommodate new technologies". He stressed on Cyber Physical Systems for "smart" and connected production systems that are designed to sense, predict, and interact with the physical world, so as to make decisions that support production in real-time to increase productivity, energy efficiency, and sustainability.

The Key Note address was delivered by Dr. Prith Banerjee, Chief Technology Officer at ANSYS, a leader in engineering simulation. Dr. Banerjee touched the subject of product design. Recently, engineered products were manually designed using MCAD or ECAD tools on a workstation, verified and validated by CAE simulation tools, prototyped in labs, and then manufactured using CNC machines and lathes in factories, supply chain etc. In his opinion, future is about using Digital Technologies in Manufacturing (Industry 4.0) - CAD on the Cloud for Collaboration, Validation and Verification on the Cloud/Unlimited Computing, AI and Machine Learning to accelerate design and simulation, Generative and Derivative Design, Design Exploration, Additive Manufacturing, Factory Automation - IOT and Connected Products, Augmented Reality/Virtual Reality for Immersive Design.

Before the closing of Inaugural session, two students from Kolkata, Arjoe Basak and Prateek Behera of Delhi Public School, Ruby Park who won the first prize in the BPMMQ were felicitated. Dr. Asim Ray, Chairman, IIM Kolkata Chapter and Mr. Aloke Mukherjee handed over the Cash award and the certificates to Arjoe and Prateek.

The Plenary Lecture, "Re-imagining the Enterprise with Technology", was delivered by Mr. Sarajit Jha, Chief (Business Transformation & Digital solutions), Tata Steel and the session was chaired by Dr. Amar Ranjan Ghosal, Director, DCPL. Mr Jha opined – "Digital transition is a journey and not a destination. As in any journey, an organization at all points of time needs to take stock of where it is vis- a -vis its own goals, peers, society and customer expectations.

The Plenary Lecture was followed by Panel Discussion on "Road Map for Implementation of Industry 4.0 In Indian Manufacturing Industries", which was Chaired by Mr. Aloke Mukherjee, Former Chairman, Flakt India.

The Technical Session- I (Industry 4.0 & Its Impact in Steel Industry), was chaired by Dr. Asim Ray, former General Manager (Quality), SAIL and presently with Lechler (India). Mr. Sanjay Agarwal, ED (Marketing) CMO, SAIL, Mr. Abhik De, Chief General Manager, IISCO Steel Plant, SAIL Mr. Joytirmoy Chatterjee, Sr. GM (Electrics & Automation-Long Products), SMS Group Mr. Abhijeet Kumar, AGM (CE&A and Digital Centre of Excellence), JSW Steel, Dolvi and Mr. Sanjay Tayade, SMS Technical & Digital Cell, JSW Steel, Dolvi delivered their talks covering various aspects of implementation challenges of Industry 4.0 in Steel Industries.

Technical Session –II (Process Control, Maintenance, Productivity & Security) was chaired by Mr. Narayan Chandra Chakrabarti, VP, Reliance Industries. Speakers for the session were Prof. Anupam Basu, Former Director, NIT, Durgapur, Prof. Susmita Sur Kolay, Professor (Higher Academic Grade), Advanced Computing and Microelectronics Unit, ISI, Kolkata, Mr. Sudip Mazumdar, Head, Digital, Manufacturing and Special Infra Projects, L&T, Mr. Anirban Nandi, GM (Global Markets, Industry 4.0), LTI Mindtree.

Technical Session -III (Implementation of Industry 4.0 in Oil, Gas and Chemical Industries). The session was chaired by Prof. Asit Mitra, Former Professor in Chemical Engineering, Jadavpur University & Former President of Indian Institute of Chemical Engineers. The speakers in this session were Prof. Amitava Gupta, Head (Power Engineering), Jadavpur University, and Mr. Praveen Gadela, JSW Steel, Dolvi.

This was followed by Concluding Session, which was conducted by Mr. Tapan Chakraborty, Former Executive Director (EMD), SAIL.

The seminar was well attended by more than 100 delegates from Industries and educational institutes. Students from Chemical Engineering department of Jadavpur University conducted the program. The seminar ended with a Vote of Thanks by Prof. Amitava Gupta of Jadavpur University.

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Seminars & Conferences

International Conference on Advanced Materials and Manufacturing Processes

The second international conference on Advanced Materials and Manufacturing Processes (ICAMPP-2023) has been organised by Department of Metallurgical Engineering, which is an integral part of Jawaharlal Nehru Technological University -College of Engineering, Vizianagaram, Andhra Pradesh on 3rd & 4th March, 2023. The department of Metallurgical Engineering has been introduced in the year 2011 and is making rapid strides as one of the premier centers of excellence in the field of Metallurgical Engineering. It offers quality technical education in B. Tech (Metallurgical and Materials Engineering), M. Tech Program in Materials Science and Technology and Ph.D Program. The prominent research areas of the department consist of metal forming, composite materials, heat treatment, ferro alloy technology, mechanical behavior of materials and corrosion. The students of department have been actively associated with "Indian Institute of Metals" and the student chapter of IIM is affiliated to IIM Visakhapatnam Chapter.

The international conference ICAMPP-2023 has been organized with the primary objective of exchanging state of the art knowledge among students, researchers, academicians, practicing engineers and technologists in the field of advanced materials and manufacturing processes. More than 300 delegates attended the conference, and the students benefitted from excellent presentations made by the experts and eminent researchers. Prof. B.S. Murty, Director, IIT Hyderabad and Vice-President & Chairman of Metal Science Division of IIM was the Chief Guest. Prof. Murty delivered plenary address on importance of Metallurgical Engineering Education and rapid strides being made in the development of advanced materials and manufacturing processes. Prof. K.V. Subbaiah, Vice-Chancellor of JNTU GURAJADA, Vizianagaram was the Distinguished Guest. In his illuminating speech he stressed the need of advanced research which servs as a backbone to the development of the country and exposure of the students to frontier areas of research on materials and manufacturing processes make them better professionals in their chosen fields. In the glittering function held during inauguration of the conference several renowned people associated with Metallurgical and Materials Engineering field were honored. These include, Prof. B.S. Murty (Chief Guest), Prof. K.V. Subbaiah (Distinguished Guest), Dr. K. Bhanu Sankara Rao (INAE Distinguished Professor, IIT Hyderabad), Shri Arun Kanti Bagachi (Director Projects and Director Operations, Rashtriya Ispat Nigam Limited, Visakhapatnam Steel Plant), Dr. Y. Srinivasa Rao, Director, Naval Science and Technological Laboratory, Visakhapatnam, DRDO), Dr. Prakash Patnaik,(Chief Scientist, National Research Council, Canada), Prof. Dr-Ing, K.G. Prasanth (Tallinn University, Estonia), Shri M. Suryanarayana Reddy (South Zonal Head

Dignitaries on the dais during inauguration. Prof. B.S. Murty (Vice-President, IIM) and Prof. K. Bhanu Sankara Rao (Chief Editor, IIM Metal News) who helped the organisers in knitting the programs were present during the inauguration along with IIM Visakhapatnam chapter members.

PAG, TATA Steel), Prof. K. Sri Kumar (Principal, JNTUGV UCEV). Prof. G. Swami Naidu (Head, Metallurgical Engineering Department) knitted an excellent program comprising of invited talks and contributory papers.

The invited talks presented at the ICAMMP -2023 comprises of : (1) Dr.Prakash Patnaik (Chief Scientist, Defence Science and Technologies, NRC, Canada) "Aerospace Materials and Technologies)", (2) Dr. Konard Kosiba (Leibniz Institut of Solid State and Materials Research, Dresden, Germany), " Machine Learning for Laser Powder Bed Fusion toward Material Synthesis by Design" , (3) Dr. K. Bhanu Sankara Rao (INAE Distinguished Professor, IIT Hyderabad), "Friction Stir Welding of Ferritic-Martensitic Steels and Bainitic Steels", (4) Dr. Pan Ma (Shanghai University of Sciences and Technology, China), "Crack Formation and Control in an AlCoCrFeNi High Entropy Alloy Fabricated by Selective Laser Melting", (5) Prof. Dr-Ing. V.V.S.S. Srikanth, School of Engineering Sciences and Technology, University of Hyderabad), "Bulk Processing of Nano Graphenaceous & Carbonaceous Materials", (6) Prof. K. Siva Prasad (NIT Tiruchirappalli), "Development of Al-Si-HEA Composites through Cast Route with Enhanced Mechanical Properties", (7) Prof. Dr-Ing. K.G. Prasanth, Tallinn University, Estonia). In addition to the above, 44 selected research papers were presented in two parallel Oral sessions.

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News Updates National

Tata Steel Mining signs MoU with GAIL to get clean fuel

In order to reduce carbon footprint in its operations, Tata Steel Mining Limited has signed a Memorandum of Understanding (MoU) with GAIL (India) Limited for supply of natural gas to its Ferro Alloys Plant at Athgarh in Odisha's Cuttack district.

According to the MoU, GAIL will supply the agreed quantity of natural gas through its pipeline from Gujarat to Athgarh.

Signing the MoU, Tata Steel Mining MD Pankaj Satija said, "As a responsible mining company, we are committed to protect the environment by using cleaner fuels and signing of the MoU with GAIL (India) Limited will further help us in this direction."

Furnace oil emits more carbon dioxide, nitrogen oxides and sulphur oxides than natural gas does. Natural gas emits 27 per cent less CO_2 and has lower levels of other pollutants, the company said in a statement.

The project will lead to Green House Gas emission reduction by 968 tons, it said.

The Economic Times (4.3.2023)

Indian steel firms likely to raise prices in March

Leading Indian steel producers are looking to raise prices of hot-rolled coils by ₹ 1,000-₹ 2,000 for March, people aware of the development said, taking prices of HRCs to the ₹ 60,000-₹ 62,000 per tonne range.

A few large steel makers had hiked prices by ₹ 500-₹ 1,000 in February as well. Price hikes in March are likely to be higher in companies that had not hiked prices in February, according to the sources.

The average prices of steel in February were around ₹ 59,500 per tonne, about ₹ 1,700 higher than the average price in January, Nomura said in a report.

The March quarter is a seasonally strong period for domestic steel makers as infrastructure and construction activities pick up during this period.

This time around, realisations for companies will also be boosted by improved demand from export markets after the government of India withdrew the export duties imposed on finished steel products in November. The March quarter will be the first full quarter without the impact of these duties this fiscal year.

The Economic Times (3.3.2023)

Jindal to invest Rs. 10,000 crore to set up 3 Mt steel plant in AP

Jindal Steel & Power limited will be investing Rs. 10,000 crore for setting up a 3 Mt per annum steel plant in Andhra Pradesh, its chairman Naveen Jindal said. This will lead to creation of 10,000 jobs, he said.

“Further to increase our investments in the state (AP), we are working on setting up a three million tonne steel plant near Krishnapatnam by investing more than Rs 10,000 crore. And more than 10,000 people are going to be getting employment here directly and indirectly," he said speaking at the Global Investors Summit 2023.

Jindal further said the group will be signing a MoU with the AP Government for investing in renewable energy across solar, wind and hydro as well expanding the capacity of its existing cement plant. The group will also be investing in a port and building slurry pipeline and a MSME park in the state.

The Economic Times (3.3.2023)

TWL-BHEL only fully Indian entity eyeing Rs 72k cr Vande Bharat contract

Titagarh Wagons Ltd (TWL) said the consortium it set up with Bharat Heavy Electricals Limited (BHEL) is the sole fully Indian entity among the five bidders for the Rs. 72,000 crore Vande Bharat trains contract. TWL, the engineering and wagon major, also said it has lined up Rs 700 crore capex over the next 4-5 years to ramp up its production capacity and related infrastructure.

The upcoming steel body facility at Uttarpara in West Bengal will strengthen TWL's coach-building capabilities in both aluminium and steel bodies, a senior company official said.

"The company after forming a consortium with BHEL is one out of five bidders for Vande Bharat. We remain optimistic. We are the only truly Indian consortium as both partners are Indians," TWL director (marketing & business development) Prithish Chowdhary told PTI in a telephonic interview.

The other bidders are German-based Siemens with BEML, Medha Engineering with Swiss company Stadler Rail, Russian Transmashholding and Rail Vikas Nigam Limited. French firm Alstom is bidding alone.

"BHEL is the lead partner but the scope of work is almost equal. The finer details will have to be worked out based on operational efficiencies of each of us if we get the contract," he said.

The Vande Bharat tender is for the supply of 200 trains from design, manufacturing, and testing to commissioning with a maintenance contract of 35 years. The total estimated value of 200 trains is to the tune of roughly Rs 72,000 crores and is expected to be completed in the next 3-4 years. This contract would be awarded to two bidders - the lowest will get 120 trains and the second lowest 80 trains.

The Economic Times (22.2.2023)

JSW Steel crude steel output surges 15 pc in Jan

JSW Steel reported a 15 per cent rise in crude steel production at 18.91 lakh tonnes in January. The company's crude steel production was at 16.46 lakh tonnes (LT) in January 2022, JSW Steel said in a regulatory filing. "JSW Steel reported highest-ever standalone crude steel production for the month of January, 2023 at 18.91 lakh tonnes, a growth of 15 per cent y-o-y on standalone basis," the filing said.

The production of its flat-rolled products increased by 14 per cent to 14.24 LT over 12.47 LT in January 2022.

The Economic Times (13.2.2023)

India steel imports from Russia rise to eight-year high in April-Jan

India's imports of Russian steel rose to an eight-year high during the first 10 months of the financial year that began in April 2022, government data compiled by Reuters showed.

India, the world's second-largest crude steel producer, imported 281,000 tonnes of steel from Russia between April and January, nearly five times higher than the same period a year ago, the data showed.

The rising imports are the result of shift in Russian steel trade flows to Asia after Western sanctions were imposed on Russia after its invasion of Ukraine

last year. The change is displacing some traditional suppliers and domestic steel producers are raising concerns about potentially losing market share to the lower priced imports.

Moscow was the fourth-biggest steel supplier to India during the April to January period, emerging as one of the top five steel exporters to the country for the first time since the 2016/17 fiscal year, the data showed.

Between April and January, about 72% of Moscow's steel shipments to India constituted hot-rolled coil (HRC) and strips. Russia displaced Japan as the second-biggest supplier of HRC to India for the first time in at least eight years, the data showed.

Russian suppliers sold some of their HRC to Indian buyers at around 46,000 Indian rupees ($555.86) a tonne, at least 21% cheaper than domestic prices, said a government official with direct knowledge of the matter.

Indian steel companies have expressed concerns over cheaper Russian steel imports.

The Economic Times (21.2.2023)

Imports of steel minimal; domestic industry progressing tremendously: Steel minister Scindia

The inbound shipment of steel is “very minimal", Steel minister Jyotiraditya M Scindia said amid industry flagging the issue of “cheap imports”. "If you look at the numbers, the rise is very very minimal. Our market is growing tremendously and our domestic producers are supplying well," the minister told PTI in reply to a question on increasing imports.

According to industry data, imports of finished steel rose by 21 per cent to 4.77 Mt in 2022 from 3.94 Mt in 2021.

Alok Sahay, secretary general of Indian Steel Association (ISA), said the industry is undergoing the pressure of supply chain issues coupled with increasing raw material prices.

ISA is the apex industry body of steel sector.

The prices of key raw material coking coal have registered a sharp increase of 55 per cent from USD 248 per tonne on December 1, 2022 to USD 345 a tonne on February 15, he said.

"Steel is exported to India by FTA (free trade agreement) countries at lower than their domestic prices, which is nothing but dumping. We have been repeatedly raising the issue of cheap imports with the ministry," Sahay said.

Coking coal is a key raw material used in manufacturing of steel and India remains dependent on imports to meet over 85 per cent of its coking coal requirement.

The Economic Times (16.2.2023)

Volatility in steel prices 'new normal'; industry needs to learn to live with it: T V Narendran

The volatility in steel prices is expected to continue and the industry must learn to live with the "new normal", T V Narendran the global CEO and MD of Tata Steel has suggested. Replying to a question on the continuous fluctuations in prices of steel, he said industry members, both producers and consumers, can not wish away the price volatility and instead should look at how it can be managed.

“I have never seen the type of volatility we have seen in the last 8 to 9 months in my 34 years of association with the industry. It's a new normal we need to learn to live with it," Narendran told PTI in a video conference.

When asked about the reason for the price volatility, the industry veteran said the steel industry is a geo-political relevant industry with long supply chains. The input materials are very volatile.

As long as the coking coal prices keep on going up and down, it will continue to impact steel prices. "I think the volatility is not something which will go away easily," Narendran said.

The Economic Times (15.2.2023)

Global operations weighing on local metal companies' margins

Leading metals companies saw their consolidated margins being weighed down by their overseas units during the quarter ended December even as their Indian operations registered a sequential recovery from the lows of the preceding quarter.

The companies include Tata Steel, JSW Steel, Hindalco and Jindal Steel & Power. However, the companies are hopeful of a turnaround in the ongoing financial quarter.

Leading steelmaker Tata Steel, which has sizeable operations in the UK and the Netherlands, reported a surprise Rs 2,502 crore loss during the period under consideration, primarily on account of its European units.

"In Q3, performance of Tata Steel in India was reasonably strong," the company's managing director TV Narendran told ET in a recent interview. The company's loss was on account of its European operations, he said, where a one-time deferred tax credit reversal and factors like high energy costs and accumulation of inventory put it in the red.

Similarly, Aditya Birla Group's aluminium unit Hindalco saw its consolidated margins narrow due to demand tanking for its US-based subsidiary Novelis. The American company is a leading supplier of aluminium cans, the demand for which was low as user industries were destocking their can inventories, said Satish Pai, managing director of Hindalco.

The Economic Times (15.2.2023)

Govt to initiate closure of SAIL's steel unit in Bhadravathi: MoS Finance

The government has decided to shut SAIL's loss-making Visveswaraya Iron & Steel Plant (VISP) at Bhadravathi in Karnataka, Parliament was informed. The government had originally planned for privatising VISP and had invited Expression of Interest (EoI) for selling SAIL's 100 per cent stake in the unit in July 2019. However, in October last year, the government decided to scrap the strategic disinvestment plans of VISP due to low bidder interest.

Business Standard (13.2.2023)

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FORM IV

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I, Kushal Saha, hereby declare that the particulars given above are true to the best of my knowledge and belief.

Date 27.03.2023 Signature of Publisher

Statistics Iron & Steel

INDIAN STEEL MARKET ROUND-UP

The following is a status report on the performance of Indian steel industry during April-January 2022-23, based on provisional data released by Joint Plant Committee (JPC) in its MIS Report for April-January 2022-23. It is to be noted that total finished steel includes both non-alloy and alloy (including stainless steel) and all comparisons are made with regard to same period of last year.

Performance of Indian steel industry			
Item	**April-January 2022-23*(Mt)**	**April-January 2021-22 (Mt)**	**% change***
Crude Steel Production	103.545	99.029	4.6
Hot Metal Production	66.824	64.676	3.3
Pig Iron Production	4.896	5.063	-3.3
Sponge Iron Production	35.855	32.698	9.7
Total Finished Steel (alloy/stainless + non-alloy)			
Production	99.480	93.409	6.5
Import	5.000	3.907	28.0
Export	5.329	11.142	-52.2
Consumption	97.100	86.967	11.7
Source: JPC; *provisional; mt=million tonnes			

Overall Production

- ***Crude Steel:*** Production at 103.545 million tonnes (Mt), up by 4.6%.
- ***Hot Metal:*** Production at 66.824 Mt, up by 3.3%.
- ***Pig Iron:*** Production at 4.896 Mt, down by 3.3%.
- ***Sponge Iron:*** Production at 35.855 Mt, up by 9.7%, led by coal-based route (82% share).
- ***Total Finished Steel:*** Production at 99.480 Mt, up by 6.5%.

Contribution of Other Producers

- ***Crude Steel :*** SAIL, RINL, TSL Group, AM/NS, JSWL & JSPL together produced 63.279 Mt (61% share) during this period, up by 3.2%. The rest (40.266 Mt) came from the Other Producers, up by 6.8%.
- ***Hot Metal :*** SAIL, RINL, TSL Group, AM/NS, JSWL & JSPL together produced 60.522 Mt (91% share) up by 4.6%. The rest (6.272 Mt) came from the Other Producers, down by 7.5%.

- ***Pig Iron :*** SAIL, RINL, TSL Group, AM/NS, JSWL & JSPL together produced 0.983 Mt (20% share) down by 22.0%. The rest (3.913 Mt) came from the Other Producers, up by 2.9%.
- ***Total Finished Steel :*** SAIL, RINL, TSL Group, AM/NS, JSWL & JSPL together produced 57.176 Mt (57% share) up by 7.0%. The rest (42.304 Mt) came from the Other Producers, up by 5.8%.

Contribution of Public Sector Units (PSU)

- ***Crude Steel :*** With 82% share, the Private Sector (85.142 Mt, up by 6.1%) led crude steel production compared to the 18% contribution of the PSUs (down by 2.1%).
- ***Hot Metal :*** With 71% share, the Private Sector (47.301 Mt, up by 6.8%) led hot metal production, compared to the 29% contribution of the PSUs (down by 4.3%).
- ***Pig Iron :*** With 93% share, the Private Sector (4.573 Mt, up by 1.3%) led pig iron production, compared to the 7% contribution of the PSUs (down by 41.3%).
- ***Total Finished Steel :*** With 85% share, the Private Sector (84.113 Mt, up by 6.4%) led production of total finished steel, compared to the 15% contribution of the PSUs (up by 7.0%).

Contribution of Flat /Non-Flat in Finished Steel

- ***Production:*** Non-flat products accounted for 54% share (up by 7.3%), the rest 46% was the share of flats (up by 5.6%).
- ***Import :*** Flat products accounted for 93% share (up by 29.2%), the rest 7% was the share of non-flats (up by 13.8%).
- ***Export :*** Flat products accounted for 87% share (down by 46.7%), the rest 13% was the share of non-flats (down by 71.2%).
- ***Consumption :*** Led by Non-flat steel (54% share; up by 7.9%) while the rest 46% was the share of flat steel (up by 16.4%).

Finished Steel Production Trends

- At 99.480 Mt, production of total finished steel was up by 6.5%.
- Contribution of the non-alloy steel segment stood at 91.586 Mt (92% share, up by 4.5%), while the rest was the contribution of the alloy steel segment (including stainless steel).
- In the non-alloy, non-flat segment, in volume terms, major contributor to production of total finished steel was Bars & Rods (41.096 Mt, up by 6.1%) while growth in the non-alloy, flat segment was led by HRC (37.995 Mt, up by 2.0%) during this period.

Finished Steel Export Trends

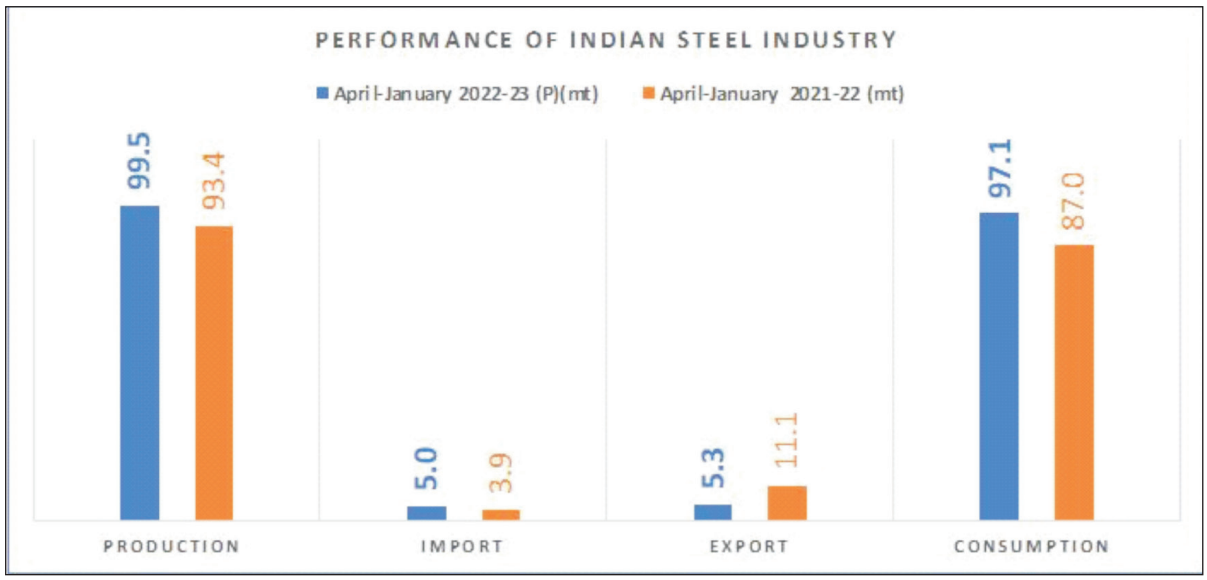
- Overall exports of total finished steel at 5.329 Mt, down by 52.2%.
- Volume wise, HR Coil/Strip (2.66 Mt) was the item most exported (40% share in total finished steel). Major share (54%) of such exports was from Alloy/Stainless.
- Vietnam (0.807 Mt) was the largest export market for India.

Finished Steel Import Trends

- Overall imports of total finished steel at 5.000 Mt, up by 28.0%.
- India was a net exporter of total finished steel in April-January 2022-23.
- Volume wise, HR Coil/Strip (1.69 Mt) was the item most imported (34% share in total finished steel).
- Korea (1.841 Mt) was the largest import market for India (37% share in total).

Finished Steel Consumption Trends

- At 97.100 Mt, consumption of total finished steel was up by 11.7%.
- Contribution of the non-alloy steel segment stood at 89.488 Mt (92% share, up by 10.9%), while the rest was the contribution of the alloy steel segment (including stainless steel).
- In the non-alloy, non-flat segment, in volume terms, major contributor to consumption of total finished steel was Bars & Rods (40.399 Mt, up by 6.6%) while growth in the non-alloy, flat segment was led by HRC (37.272 Mt, up by 16.7%) during this period.



https://jpcindiansteel.nic.in/

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Steel Statistics Global

Crude Steel production by region (Jan)

	Jan 2023 (Mt)	% change Jan 23/22	Jan-Jan 2023 (Mt)	% change Jan-Jan 23/22
Africa	1.2	-4.9	1.2	-4.9
Asia and Oceania	107.5	-0.2	107.5	-0.2
EU (27)	10.3	-15.2	10.3	-15.2
Europe, Other	3.3	-17.5	3.3	-17.5
Middle East	3.8	19.7	3.8	19.7
North America	9.1	-5.6	9.1	-5.6
Russia & other CIS + Ukraine	6.5	-24.9	6.5	-24.9
South America	3.6	-0.6	3.6	-0.6
Total 63 countries	**145.3**	**-3.3**	**145.3**	**-3.3**

The 63 countries included in this table accounted for approximately 97% of total world crude steel production in 2022. Regions and countries covered by the table:

- **Africa:** Egypt, Libya, South Africa, Tunisia
- **Asia and Oceania:** Australia, China, India, Japan, Mongolia, New Zealand, Pakistan, South Korea, Taiwan (China), Thailand, Viet Nam
- **European Union (27)**
- **Europe, Other :** Macedonia, Norway, Serbia, Türkiye, 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, Russia, Ukraine
- **South America :** Argentina, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela

Top 10 steel-producing countries

	Jan 2023 (Mt)	% change Jan 23/22	Jan-Jan 2023 (Mt)	% change Jan-Jan 23/22
China	79.5 e	2.3	79.5	2.3
India	10.9	-0.2	10.9	-0.2
Japan	7.2	-6.9	7.2	-6.9
United States	6.5	-6.8	6.5	-6.8
Russia	5.8 e	-8.9	5.8	-8.9
South Korea	5.5	-9.8	5.5	-9.8
Germany	2.9	-10.2	2.9	-10.2
Brazil	2.8	-4.9	2.8	-4.9
Iran	2.7 e	27.7	2.7	27.7
Türkiye	2.6	-17.6	2.6	-17.6

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

Source : worldsteel.org

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