THE INSTITUTE OF INDIAN FOUNDRYMEN

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COVER FEATURE

Design of lightweight castable multicomponent alloys through high-throughput Calphad and machine learning

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Auto industry growth likely to be 3-6% in FY27 as high base kicks in: ICRA

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Design of lightweight castable multicomponent alloys through high-throughput Calphad and machine learning

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Lightweight multicomponent alloys are of great interest due to the remarkable hardness they exhibit. Optimizing the alloying compositions of such alloys to achieve a synergistic combination of weight, strength and ductility remains a challenge. In the present work, a design strategy for lightweight multicomponent alloys is developed to synthesise alloys with improved ductility. This novel alloy design strategy combines Calphad based high-throughput calculations with machine learning (ML) to select suitable compositions. Two new alloy compositions were developed and their mechanical testing results validated the proposed alloy design procedure.
Keywords: Multicomponent, Alloy, Calphad, Ductility, Machine Learning.

1.Introduction

The two most fundamental properties desirable in a structural material are strength and ductility. Additionally, when a component made from such material is intended for non-stationary applications, the weight of the component becomes another critical deciding factor. Therefore, an ideal structural alloy for mobile applications should possess high strength, high ductility, and low density.

It is well known that multi-component alloys, due to the presence of various alloying elements, tend to form multiple phases and solid solutions [1]. Consequently, a multi-component alloy inherently benefits from solid solution and phase-based strengthening mechanisms. If such materials could also exhibit higher ductility and have lower density, they would represent a winning combination.

For over a century, it has been a constant endeavour for physical metallurgists to develop alloy systems that exhibit all the above properties. This task is non-trivial, as the possible combinations of alloying elements and their resulting properties could be extensive. However, with the advent of artificial intelligence and machine learning, these challenges could be addressed through physics-constrained machine learning approaches [2][3][4][5].

In the current work, an attempt has been made to develop such alloy systems using known and simulated physical data within a machine-learning framework.

Over the last two decades, alloy discovery activities have been driven by computational algorithms. Initially, these activities were propelled by Integrated Computational Materials Engineering (ICME) approaches [6][7]. In the latter half of the last two decades, they have increasingly been driven by Machine Learning (ML) [8].

Machine Learning (ML) has been extensively applied to the discovery of high-entropy alloys (HEAs), a class of materials introduced by Cantor and Yeh in 2004 [9]. HEAs typically consist of four or five elements with nearly equal atomic percentages, each exceeding five percent. Their high configurational entropy favours the formation of solid-solution phases, predominantly with FCC, BCC, or HCP structures. These alloys are distinguished from conventional alloys by their complex compositions, resulting in exceptional properties such as high mechanical strength, superior fatigue and wear resistance, excellent magnetic properties, and exceptional irradiation and corrosion resistance.

The inherent complexity and vast performance tuning space of HEAs make traditional experimental trial-and-error methods inefficient and costly. Recently, computer-assisted design methods, particularly high-throughput calculations (HTC), have significantly advanced HEA research [10][11]. HTC enables efficient, large-scale computations, providing rapid predictions of material properties and phase stability without relying on empirical parameters. Despite these advancements, HTC methods require validation through experiments to ensure accurate performance predictions. The integration of artificial intelligence (AI) and ML further enhances HEA design by capturing complex patterns and predicting properties based on comprehensive datasets.
The use of ML for alloy discovery has been particularly effective for HEAs due to their unique combination of multiple elements, which prevents reaching a low equilibrium configuration. This results in superior chemical, mechanical, and physical properties. ML leverages large datasets to predict phase stability [12] and mechanical properties [13][14] moving beyond traditional empirical methods. Various ML algorithms, including decision trees, neural networks, and support vector machines, model the relationships between alloy composition and properties, with deep learning proving particularly effective [15][16][17]

ML can also address the challenges in HEA development by utilizing high-throughput techniques (HTC) and data-driven approaches. HTC and characterization methods generate extensive datasets, which ML algorithms analyze to uncover intricate structure-property relationships [18]. This integrated approach, inspired by the Materials Genome Initiative, combines experimental data, theoretical models, and computational simulations to predict and optimize HEAs on an unprecedented scale.

ML algorithms enable the rapid identification of optimal alloy compositions by modelling the complex interplay between composition and properties. These models screen large compositional spaces and predict desired properties, providing intelligent feedback to guide further experimental efforts. The synergy between high-throughput experiments and ML accelerates the development of advanced HEAs, paving the way for innovative materials with enhanced performance for various applications.

In the present work, the physical property of interest is ductility and density. While density can be addressed by increasing the amount of lightweight elements such as aluminium, Magnesium, lithium, etc, the studies on ductility have been limited. Ductility represented by elongation to fracture has been correlated to Pugh's ratio and Cauchy pressure [19]. A Pugh's ratio of less than 0.56 or a positive Cauchy pressure indicates the element is ductile, however, their application to alloys has been limited. Therefore to achieve high ductility a combination of machine learning and high throughput Calphad is employed and the results have been experimentally tested.

1.Design Strategy

The design strategy aims to identify lightweight multicomponent compositions that can be cast with acceptable ductility. As the number of possible alloy combinations is large and the ability of machine learning models to generalize material behaviour is limited by available data, the use of Calphad in conjunction with ML modelling is proposed to improve the alloy selection process. First, a high-throughput Scheil solidification calculation was set up with Calphad to explore aluminium-based compositions with favourable phases. The solutions generated were used as input for an ML model to predict ductility (tensile elongation) and corresponding uncertainty. The final alloys selected were synthesized and mechanically tested to validate the design strategy. A flowchart of the proposed approach is given in Figure 1.

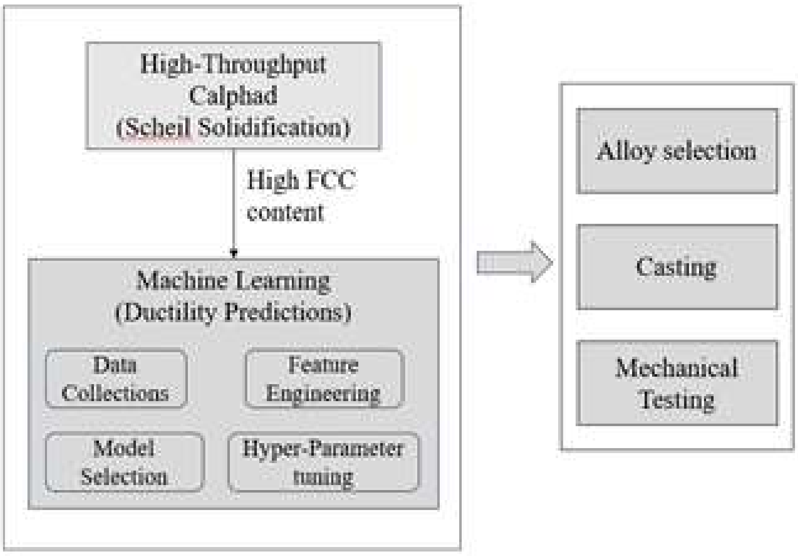


Figure 1. Flowchart of the alloy design strategy

2.1 Calphad high-throughput calculations

To identify suitable composition windows with acceptable ductility and low density, a high-throughput Scheil solidification calculation is set up in Pandat [20] using the PanAl2022 thermodynamic database. This solidification model is based on the assumption of complete diffusional mixing in the liquid state but no diffusion occurring in the solid state, which is a more accurate representation of solidification conditions than an equilibrium solidification model based on infinite diffusion in both states. The alloying elements chosen are those with higher reported solubilities in aluminium, namely, Zinc, Magnesium, Silicon and Copper. The primary output from these calculations are fcc volume fractions, however, secondary estimates such as solidus temperature, latent heat capacity, Gibbs free energy and enthalpy are also obtained for each calculation point to examine correlations with ML predictions.

2.2. Machine learning modelling

The compositions from high-throughput calculations are used in the ML model to predict their ductility. The modelling process consists of the following steps: data collection → feature extraction → feature screening → model selection → hyperparameter tuning → ductility predictions.

2.2.1 Data collection.

Data is essential for training machine learning models and given large enough data all ML models are reported to perform similarly [21]. In material science, however, there exists an infinitely large number of alloy combinations with only a limited amount of experimental data available. This limitation in data necessitates the careful selection of ML models. The main target data for our model is ductility, which is represented by elongation exhibited in uniaxial tension/compression testing. We collected experimental data from published literature which includes data for pure alloys, conventional alloys as well as HEAs alloys. The data labels collected included composition details, primary and secondary processing details, experimental conditions as well as the target material property. The elements present in the collected data are shown by their frequency of occurrence in Figure 2.

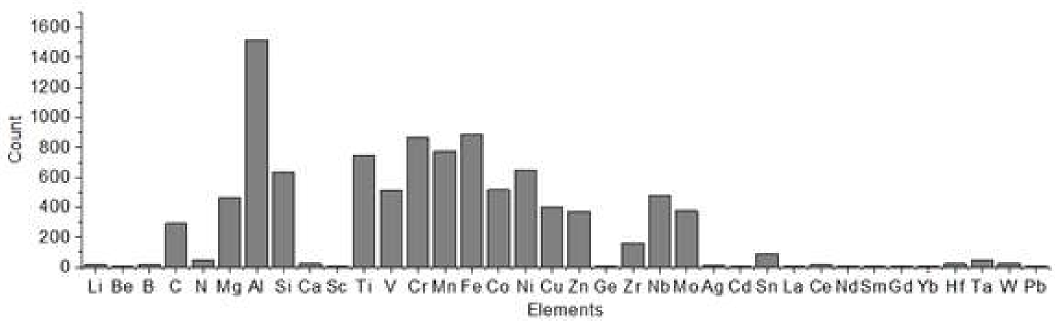


Figure 2. The frequency of occurrence of each element present in the dataset.

1.2.2Feature extraction.

A large number of features were generated for each composition present in the dataset denoting the physical and chemical attributes of the alloying elements. These features were created using Python libraries MASTML [22] and Matminer[23]. They include the compositional mean, max and min of physical properties such as atomic number factor, electro-chemical factor, group number factor, cohesion-energy factor, Mendeleev number factor and many more. The total features generated are 554 and they will be screened to reduce their dimensionality.

2.3 Feature screening

As the number of features generated in the prior step is very large, a feature screening step is implemented to identify the key features relating to material ductility. A two-step feature screening method is adopted. The first step is to remove highly correlated features based on Pearson's correlation coefficient (r). If two features have a high correlation then the information they represent is similar, and it would be redundant to include both features.

A threshold of $|r| > 0.7$ is selected, resulting in the removal of 433 features with 121 features remaining. For further screening of features, a second step based on Recursive Feature Elimination(RFE) is constructed. RFE is an iterative method, where in each iteration an ML model is developed using existing features and the least significant feature is removed [24]. The process continues until a predefined number of features is obtained. In the present study, the RFE algorithm is paired with a Random Forest model (RF) which provides it with metrics for ranking feature importance.

2.4 Model selection

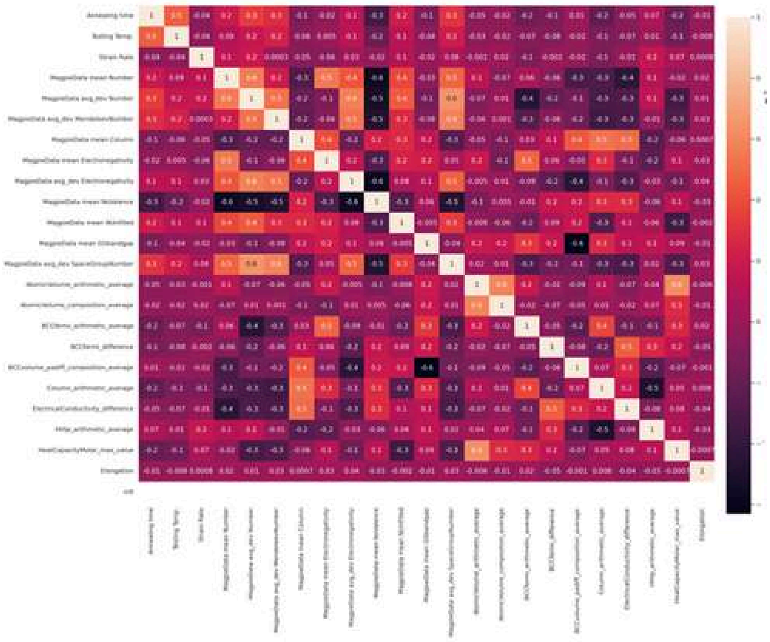
As the problem of modelling material ductility is a regression one with labelled data as an input, a vast variety of supervised machine learning algorithms can be used. Four different ML algorithms are used to model ductility and the model with the highest testing scores is chosen. The models considered are (a) linear regression (LR) (b) random forest (RF) (c) gradient boosting regression (XGB) and (c) kernel ridge regression (KRR).

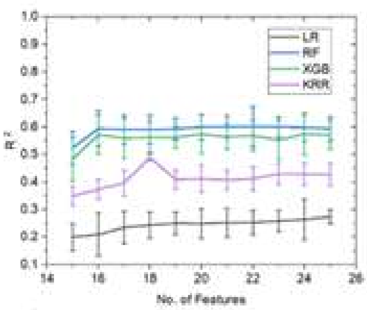
While a linear regression algorithm [25] models the data as having linear dependence between the independent and dependent variables, Random forests (26) use bagging to build a large collection of de-correlated trees, and then averages their influence.

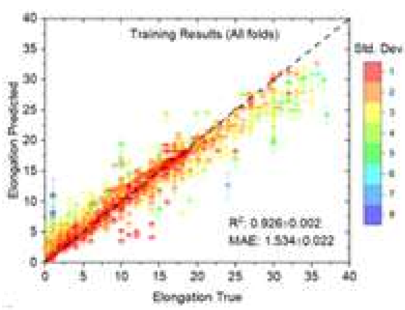
The random forest predictor can be written mathematically as shown in Eq1, where B is a tree generated by bagging and Θ_b characterizes the b^{th} random forest tree in terms of split variables, cutpoints at each node, and terminal-node values.

Gradient boosting on the other hand utilizes ensemble methods to multiple weak models and aggregates them to get better performance as a whole. Kernel Ridge Regression (KRR) combines ridge regression (linear least squares with L2 regularization) with a kernel trick, which allows it to learn non-linear relationships between input variables and the target variable.

These models are trained using the repeated k-fold cross-validation technique, where the number of repeats is 3 and the number of folds is 5. In n-fold cross-validation, the total data is randomly divided into n sets, with n-1 sets used for training and the rest used for testing. This testing and training step is repeated n times till all sets have been used for both testing and training. In a repeated n-fold cross-validation technique, the n-fold cross-validation procedure is simply repeated 'm' times, with the partitioning of data into the n-folds being different in each of the m-repeats due to randomization. The results show that the RF model outperforms all other models. The highest testing r^2-score (coefficient of determination) achieved during model selection is 0.602(averaged across all the folds) with an input of 22 RFE-screened alloy features. To assess the importance of features a Pearson's correlation heatmap is generated as shown in Figure 3a. The highest positive correlation is observed with "Avg deviation in electronegativity", while the highest negative correlation is with "BCC fermi difference". To further improve the RF model a hyperparameter optimization loop was set up to optimize the parameters "n_estimators" and "max_features", followed by a 10-repeat 10-fold cross-validation. The final training and testing results are shown in Figure 3(c) &(d). The final testing r^2-score of the model is 0.61 averaged across all folds and the training score is 0.926. The testing results indicate that the model is overpredicting the elongation at lower values and under-predicting for higher values.







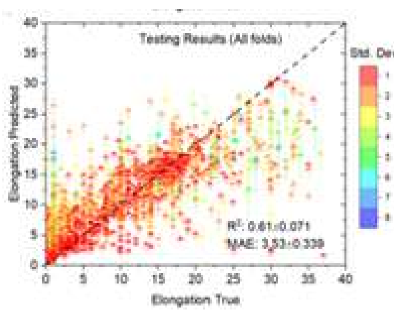


Figure 3. (a) Pearson's correlation heatmap highlighting the influence of each feature on elongation. BCC_fermi difference has the highest correlation with elongation. (b) ML model selection results show RF outperforming all other models. The RF model attains the maximum testing score with 22 features included in the model. (c) Training and (d)Testing results after hyperparameter tuning and 10-repeat 10fold cross-validation.

2.5. Experimental Procedures

Based on the alloy design strategy two new lightweight alloys are selected for casting. The selected alloys are produced by performing induction melting of pure Al, pure Zn and AlCu50 master alloy followed by permanent mould casting. The molds were preheated to 200°C and the alloys were quenched immediately after casting. Tensile samples are machined out of the as-cast samples using a wire EDM with a gauge length of 22mm. Uniaxial tension tests are carried out using an MTS tensile tester of 20KN capacity at a strain rate of 0.001/s. A laser extensometer was used to measure the strain in the gage length.

1.Results and discussion

The results of the machine learning algorithms to predict the properties of potential alloys are displayed in Fig 4.

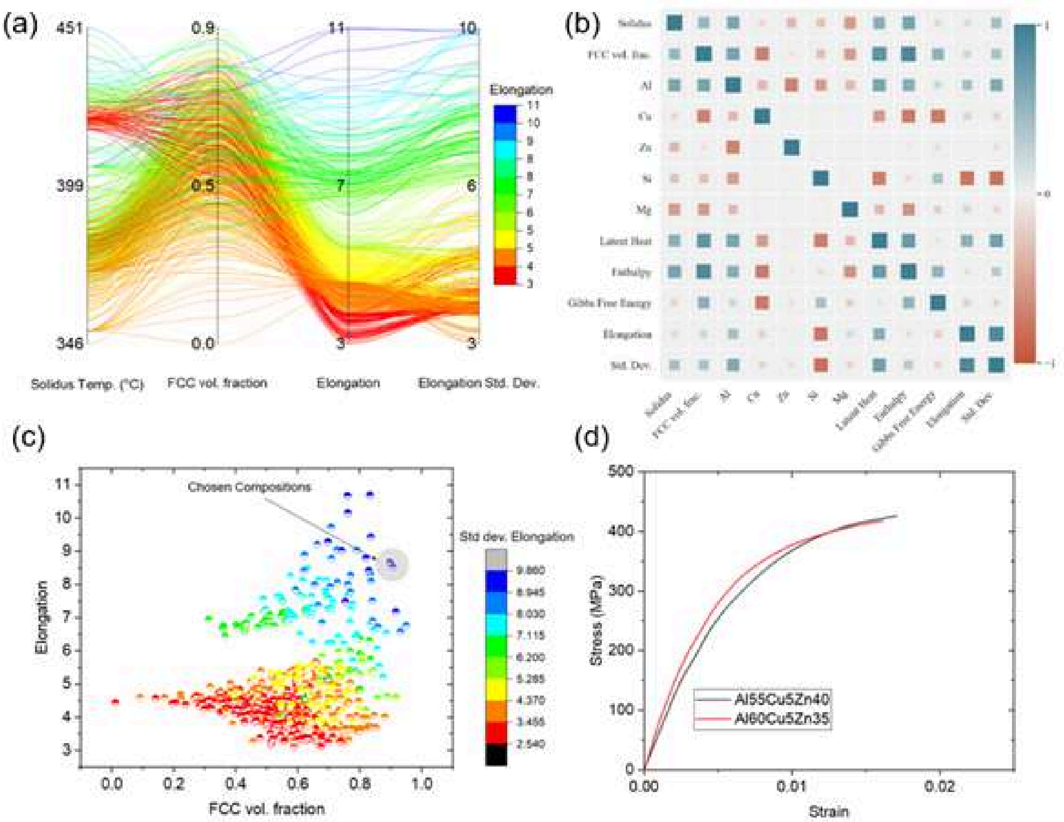


Figure 4. (a) Results of HTC calculations and subsequent ML predictions (b)Heat map showing correlations of HTC Scheil solidification calculations and ML predictions (c) Predicted elongation vs calphad fcc volume fraction (d) tensile testing results of fabricated alloys

The primary data to feed machine learning algorithms for each alloy system was generated using thermodynamic calculations using CALFAD. Figure a depicts the variation and solid as temperature for the range of algorithms being evaluated using machine learning and their potential phase content (fcc phase volume fraction) along with predicted elongation and its standard deviation. As can be seen, there are inherent patterns which relate to phase fraction elongation and standard deviation in elongation. The set of all variables both the feature vectors and the output are plotted as the heat map in Figure B. This shows the relative correlation of each variable. The diagonal being the trivial case with perfect correlation. This hit map is an example of many thousand calculations and that should not be seen as a cause-and-effect relation. It is possible that for a specific alloy composition, a specific variable may cause a very large elongation however in an ensemble heat map we may find a weak correlation. Therefore, this figure cannot be taken as a relation between various variables but should only be taken as a potential set of important features required in the machine learning algorithm. To visualize the predicted four-dimensional space of solidus temperature, fcc volume fraction, elongation and elongation standard deviation it has been projected on a two-dimensional plane containing just fcc volume fraction and elongation as shown in Figure C. However, a colour encoding based on standard deviation elongation has been used to identify various regions.

It is found that despite a lower dimensional projection there is a strong grouping of data based on standard deviation elongation. In general, one would like to have high elongation and low standard deviation elongation; however as can be seen in the distribution of predicted data, such an instance does not exist. Therefore two points (corresponding to two alloy compositions) as highlighted and Figure C, belonging to high elongation and fcc volume fraction (all be it high standard deviation elongation) were chosen for experimental validation. The choice of these two points was not arbitrary, but are based on sound physical metallurgical principles since these two particles had higher fcc volume fractions their predicted large elongation has more sound physics-based reasoning apart from the predictions from the machine learning algorithm. These two compositions were Al55Cu5Zn40 and Al60Cu5Zn35.

As described before, these two specific alloys were experimentally fabricated and tested for their strength and elongation. They both being high in aluminium content were inherently lightweight. The stress-strain curve of the tensile test conducted on these two alloys is provided in Figure D. As can be seen, the ask caste alloy has over 3% strain to failure and a strength of over 400 MPa. This is quite an achievement since the as-cast alloy system exhibits very low strain to failure. The two alloys also show substantial plastic deformation (nonlinear behaviour beyond elasticity) and have a substantial area under the curve up to failure.

A more apple-to-apple comparison would be possible if these alloys are later processed under thermo-mechanical treatment and the wrought properties are used as a baseline for comparison. This of course is a preliminary study and as more data, not just from thermodynamic calculations but also experimental results becomes available machine learning will become more precise and accurate. It is envisaged that in future, with advancement in automated experimental systems, artificial intelligence algorithms would not only predict possible alloy systems but would also run them on such automatic experimental systems to self-correct their models leading to a positive feedback system to perform new alloy Discoveries.

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AI Impact Summit 2026 Concludes with Adoption of New Delhi Declaration

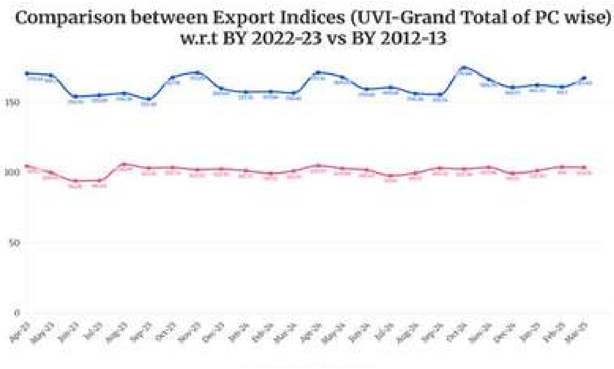
89 countries and international organisations endorse a shared global vision for collaborative, trusted, resilient and efficient AI

Key Deliverables: Global Platforms, Principles and Collaborative Mechanisms Announced Across 7 Pillars.
India leads call for "AI for All" rooted in equity, access and global cooperation
The AI Impact Summit 2026, held in New Delhi on 18–19 February, concluded with the adoption of the New Delhi Declaration on AI Impact, marking a significant milestone in global cooperation on artificial intelligence.
The Declaration has been endorsed by 89 countries and international organisations, reflecting a broad-based global consensus on leveraging AI for economic growth and social good.
A Shared Global Vision for AI
Guided by the principle of "Sarvajan Hitaya, Sarvajan Sukhaya" (Welfare for all, Happiness for all), the Declaration underscores that the benefits of AI must be equitably shared across humanity read more..

India-Brazil MoU Signed to Deepen MSME Cooperation and Advance Green Transition

MoU Signed During President Lula's Visit to Boost MSME Collaboration and Sustainable Growth

During the ongoing visit of delegation led by H.E. Luiz Inácio Lula da Silva, President of Brazil to India, the Ministry of MSME, Government of India, has signed a Memorandum of Understanding (MoU) with the Ministry of Entrepreneurship, Micro and Small Enterprises of the Federative, Republic of Brazil on 21.02.2026.
The MoU will provide a platform for both sides to discuss the issues concerning Micro, Small and Medium Enterprises (MSMEs) and explore possible areas of cooperation for mutual benefit of MSMEs in the two countries. It will provide a framework and enabling environment for the MSMEs of both countries to understand each other's strengths, markets, technologies and policies read more..



Directorate General of Commercial Intelligence and Statistics Revises Base Year of Merchandise Trade Indices to FY 2022-23 to Reflect Current Trade Structure and Global Patterns

Posted On: 20 FEB 2026 6:35PM by PIB Delhi
Merchandise Trade Indices are compiled and published by the Directorate General of Commercial Intelligence and Statistics (DGCI&S), Ministry of Commerce & Industry, to measure changes in the unit values (prices) of India's exports and imports over time. These indices serve as important indicators of external sector price movements and are widely used for economic analysis, including national accounts compilation and assessment of terms of trade. Over the years, the base year of the indices has been periodically revised to reflect structural changes in India's trade composition and evolving global trade patterns. The most recent revision updates the base year to FY 2022-23 (2022-23 = 100), replacing the earlier base of FY 2012-13, thereby ensuring that the indices accurately represent the current structure of India's merchandise trade read more..

DPIIT and National Productivity Council Organize 'Chintan Shivir on Boilers' to Foster Innovation and Align Industry Roadmap with Vision 2047

The Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce and Industry, Government of India, in association with the National Productivity Council (NPC), organized a 'Chintan Shivir on Boilers' at Hyderabad.
The Chintan Shivir was organised with the objective of fostering innovation, reviewing policy implementation and aligning strategies with long-term national goals such as "Vision 2047" through collaborative and forward-looking discussions. The deliberations focused on preparing a roadmap for the boiler industry by engaging key stakeholders across the ecosystem.
The event was attended by Director General, National Productivity Council, Smt. Neeraja Shekhar, Joint Secretary, Department for Promotion of Industry and Internal Trade, Shri Jai Prakash Shivahare, and Technical Adviser (Boilers) and Secretary, Central Boilers Board, Department for Promotion of Industry and Internal Trade, Shri Sandeep Sadanand Kumbhar. Representatives of State Governments, boiler manufacturers, boiler users, Third Party Inspecting Authorities (TPIAs) read more..

Union Minister of Commerce and Industry Shri Piyush Goyal Launches Export Promotion Mission to Boost MSME Exports and Strengthen Global Competitiveness

Inclusive Growth Key to Social Justice; AI and Emerging Technologies to Drive India's Future Growth: Shri Piyush Goyal. Export Promotion Mission to Expand Market Access for MSMEs; India Records Double-Digit Export Growth in February: Shri Goyal
Niryat Protsahan Introduces Export Factoring, E-Commerce Credit and Emerging Market Support with Interest Subvention and Credit Guarantees for MSMEs

The Union Minister of Commerce and Industry, Shri Piyush Goyal, today launched seven additional interventions under the Export Promotion Mission (EPM), a flagship initiative of the Department of Commerce aimed at empowering Micro, Small and Medium Enterprises (MSMEs) for global markets. These interventions are designed to address key challenges faced by Indian exporters, promote broad-based and inclusive export growth, and strengthen India's position as a globally competitive export powerhouse. Commerce Secretary, Shri Rajesh Agarwal, also graced the occasion read more..

Cabinet approves Startup India Fund of Funds 2.0 to Mobilize Venture Capital for India's Startup Ecosystem

In a major boost to India's growing startup ecosystem, the Union Cabinet chaired by the Prime Minister, Shri Narendra Modi, has approved the establishment of the Startup India Fund of Funds 2.0 (Startup India FoF 2.0) with a total corpus of Rs. 10,000 crore for the purpose of mobilizing venture capital for the startup ecosystem of the country.
The Scheme is designed to accelerate the next phase of India's startup journey by mobilising long-term domestic capital, strengthening the venture capital ecosystem, and supporting innovation-led entrepreneurship across the country read more..

EPFO REFORMS

The following initiatives have been taken to expand registration and improve regional coverage:
I.Common registration through Shram Suvidha portal and Auto-registration for new companies incorporated under Companies Act through MCA Portal: As part of Ease of Doing Business, Shram Suvidha Portal, a unified platform, was introduced by Ministry of Labour & Employment, whereby any establishment seeking EPFO registration can register online by furnishing the necessary data and documents.
Further, from February 2020, auto registration under EPFO is being done for Public and Private Limited Companies and One Person Companies at Ministry of Corporate Affairs registration portal through Spice+ and AGILE-PRO e-forms.
II.Implementation of EPF & MP Act, 1952 in J&K and Ladakh: Consequent upon implementation of Employees' Provident Funds and Miscellaneous Provisions Act (EPF & MP Act), 1952 in the UTs of J&K and Ladakh w.e.f. 31st October 2019, EPFO has extended its provident fund, pension and insurance benefits to all employees of existing establishments covered under the erstwhile JK PF Act as well as the employees of newly covered establishments read more..

Commerce and Industry Minister Piyush Goyal urges Export Promotion Councils and Industry bodies to utilize FTAs to gain greater presence in world markets

Industry must now intensify its efforts to penetrate new markets, upgrade quality and become more competitive: Shri Goyal
Union Commerce and Industry Minister Shri Piyush Goyal has urged exporters and industry bodies to take full advantage of the series of Free Trade Agreements signed with developed countries maximise job creation and boost exports of goods and services.
The minister met 35 Export Promotion Councils (EPCs) and key Industry Associations representing India’s major export sectors. Industry leaders and association office bearers appreciated the government’s trade-promotion initiatives during their interaction with the minister.
Shri Goyal said the Modi government had signed Free Trade Agreements with developed countries to help India’s farmers, workers, professionals, artisans and MSMEs take advantage of the global market with preferential access. With these trade agreements, India’s traditional medicines and yoga will also get global opportunities, while the interest of India’s agriculture and dairy sectors have been protected read more..

IMPACT OF 'MAKE IN INDIA' ON AUTOMOBILE INDUSTRY

As per information received from Society of Indian Automobile Manufacturers (SIAM),the category-wise automobile production during the last five years, including the share of electric vehicles is as under :-

Category	2020-21	2021-22	2022-23	2023-24	2024-25
Passenger Vehicles	3,062	3,651	4,587	4,902	5,061
Commercial Vehicles	625	806	1,036	1,068	1,033
Three Wheelers	615	759	856	996	1,050
Two Wheelers	18,350	17,821	19,459	21,469	23,884

More information..

Auto industry growth likely to be 3-6% in FY27 as high base kicks in: ICRA

The Indian automotive industry is expected to see a moderation in wholesale volume growth in FY2026-27, settling in the range of 3–6 per cent, as the sector moves past a phase of elevated growth witnessed in the second half of FY2025-26, according to Icra. The ratings agency attributed the earlier surge to post-Goods and Services Tax (GST) reform factors, supportive rural demand conditions and policy-led stimulus, while flagging that the upcoming fiscal will contend with a higher base.

Icra said FY2025-26 has played out unevenly for the sector, with subdued demand in the first half followed by a sharp recovery in the latter months. The rebound was supported by GST rate cuts, pent-up demand, improved rural output and a favourable financing environment. While demand sentiment remains optimistic, wholesale volumes have already reached levels that are likely to limit the scope for outsized growth in FY2026-27 read more..

India-US trade deal to boost auto suppliers, says Nomura; lists top winners

The India-US trade deal is set to benefit Indian auto part exporters by providing preferential tariff treatment and boosting global competitiveness, according to analysts at Nomura. Following the deal, India will receive a specific tariff rate quota for automotive parts exports to the United States of America (USA), allowing nearly half of these shipments to enter at zero duty.

Earlier, these products faced tariffs of around 25 per cent under Section 232. The agreement also extends to aircraft and aircraft components.

Nomura highlighted that aerospace companies Boeing and Airbus currently source around $1.25 to $1.5 billion worth of aerospace components from India, which could increase substantially after the trade deal read more..

Mundra Port posts record auto exports, liquid cargo volumes in January

Adani Group's Mundra Port in Gujarat has recorded a sharp increase in automobile exports and liquid cargo volumes in January 2026, posting multiple operational records that highlighted the growing role of large, integrated ports in supporting India's trade and export flows.

The port handled its highest-ever monthly automobile export volume, shipping 25,762 vehicles through its dedicated roll-on/roll-off (RoRo) terminal at Adani Mundra Container Terminal (CT2), officials said.

The figure surpassed the previous monthly record set in May 2024, reflecting continued overseas demand for India-manufactured vehicles.

Automakers, including Maruti Suzuki and Toyota, increasingly routed exports through Mundra during the month, with shipments destined for markets across Africa, Europe, East Asia, Australia, and the Middle East, according to port officials read more..

US-India tariff reset lifts engineering exports; auto components lead gains

India's engineering exports to the United States (US) are set to regain momentum following the proposed reduction in US reciprocal tariffs on Indian goods to 18 per cent, significantly improving cost competitiveness after years of elevated duties. Auto component manufacturers are expected to be the biggest beneficiaries, with the tariff reset sharpening India's export edge in the US market far more for ancillary suppliers than for automobile OEMs (original equipment manufacturers).

India exported goods worth $86.5 billion to the US in 2024-25 (FY25), with engineering goods emerging as the largest category at $20.1 billion. The segment includes electrical equipment, industrial machinery, iron and steel products, automobiles, and auto parts. According to industry calculations, around 62 per cent of India's engineering exports to the US will be covered under the tariff reduction, bringing duties down from 50 per cent to 18 per cent. This is expected to restore competitiveness for products such as machinery, castings, electrical equipment, boilers, and compressors that had struggled to absorb the higher tariff burden read more..

Budget 2026 boosts startups, MSMEs with ₹10,000 crore funds, credit push

India's Union Budget for 2026–27 outlined a series of measures aimed at startups and small businesses, with a focus on improving access to funding and credit, supporting manufacturing, and easing regulatory burdens. Finance Minister Nirmala Sitharaman announced a Rs 10,000 crore SME Growth Fund for the micro, small and medium enterprises sector, as global trade and economic uncertainties continue to weigh on the industry.

"I propose to revive 200 legacy industrial clusters… introduce a Rs 10,000 crore SME Growth Fund," Sitharaman said.

She also proposed topping up the Self-Reliant India Fund, set up in 2021, with Rs 2,000 crore to continue support for micro enterprises and maintain their access to risk capital read more..

India joins BRICS centre for industrial competencies to support manufacturing and MSME sector

India has joined the BRICS Centre for Industrial Competencies (BCIC) at an event organised by the Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce & Industry. The BCIC, launched in partnership with the United Nations Industrial Development Organization (UNIDO), serves as a one-stop centre providing integrated support services to manufacturing companies and Micro, Small and Medium Enterprises (MSMEs) across BRICS countries, with a focus on strengthening Industry 4.0 competencies. Following this, a Trust Fund Agreement was signed between DPIIT and UNIDO. The National Productivity Council (NPC) has been designated as the India Centre for BRICS Industrial Competencies. Under the policy guidance of DPIIT and with technical support from UNIDO, NPC will spearhead Indias read more..

Reserve Bank of India raises collateral-free MSME loan limit to Rs 20 lakh

The Reserve Bank of India (RBI) has revised its lending norms for the micro, small and medium enterprises (MSME) sector, raising the ceiling for collateral-free loans to micro and small enterprises (MSEs) to Rs 20 lakh. Under the amended directions, banks have been instructed not to insist on collateral security for loans of up to Rs 20 lakh extended to MSE units. Lenders have also been advised to provide collateral-free loans up to the same limit to all beneficiaries covered under the Prime Minister Employment Generation Programme (PMEGP), which is implemented by the Khadi and Village Industries Commission (KVIC).

Banks may further relax collateral requirements for loans up to Rs 25 lakh for MSEs with a satisfactory repayment history and sound financial position, subject to their internal credit policies. In such cases, lenders may avail coverage under the Credit Guarantee Scheme, wherever applicable. The central bank noted that voluntary pledging of gold or silver by borrowers for loans sanctioned within the collateral-free limit will not be treated as a breach of the directive read more..

CNH India to resume US tractor exports; invest ₹1,800 cr after tariff cut

Italian-American agriculture equipment firm CNH's India unit plans to resume full-scale tractor exports to the US and invest approximately ₹1,800 crore over the next two to three years, capitalising on a recent India-US trade agreement that reduced tariffs on Indian goods to 18 per cent from as high as 50 per cent.

The New Delhi-based subsidiary, which operates brands like New Holland and Case IH, halted most US-bound shipments late last year after higher duties made them unprofitable. Production for the US market was paused in the final months of 2025, except for limited-compact tractor models used for testing and customer trials read more..

India, China among winners after US Supreme Court blocks Trump tariffs

In a swift reversal of fortunes, countries that had been hardest hit by US President Donald Trump's tariffs have emerged as the biggest winners from the Supreme Court's decision to strike down his emergency levies.

China, India and Brazil are among those now seeing lower tariff rates for shipments to the US after the court ruled on Friday that Trump's use of the International Emergency Economic Powers Act to impose duties was illegal. While Trump subsequently announced plans for a 15 per cent global rate, Bloomberg Economics calculated that would mean an average effective tariff rate of around 12 per cent — the lowest since his "Liberation Day" tariffs were released in April.

For Asia, Morgan Stanley economists say the weighted average tariff rate will fall to 17 per cent from 20 per cent, with average levies on goods from China declining to 24 per cent from 32 per cent. Relief may be temporary as the Trump administration seeks to impose sectoral and economy-specific duties to rebuild its tariff regime read more..

Export Promotion Mission thoughtfully structured; impact uncertain

The Directorate General of Foreign Trade (DGFT) has now moved the Export Promotion Mission (EPM) from announcement to implementation. Detailed guidelines were issued last week under four schemes of EPM — Niryat Disha and one under EPM — Niryat Protsahan seeking feedback from the trade. Comments have also been invited on the draft Digital Trade Facilitation Bill, 2026. These measures are welcome. Whether they materially shift India's export competitiveness remains to be seen.

The EPM was announced in the Budget 2025-26 speech to address two long standing concerns: uneven access to export credit and rising compliance costs due to non-tariff measures (NTMs) in overseas markets. On November 12, 2025, the government approved an overall outlay of ₹25,060 crore for the Mission along with a ₹20,000 crore Credit Guarantee Scheme for Exporters (CGSE). The two sub-schemes under EPM are Niryat Protsahan to focus on affordable trade finance, especially for MSMEs and Niryat Disha to address non-financial bottlenecks such as certification, logistics and market access.

Earlier measures under EPM included Market Access Support (MAS) for trade fairs and buyer-seller meets, and a 2.75 per cent interest subvention on pre-shipment and post-shipment export credit from banks read more..

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MSME ODR PORTAL:

WHERE MSE DISPUTES MEET DIGITAL RESOLUTION

Explore Early Settlement Support through the Digital Guided Pathway, which:

A

Provides a suggestive probable outcome after parties submit their case facts.

B

Supports informed decision-making and promotes amicable resolution

C

Serves solely as a guidance tool and does not constitute a final decision

D

Ensures that unresolved cases proceed to MSEFC for resolution as per law

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Online Dispute Resolution (ODR Portal)

The Ministry of MSME has developed an end-to-end Online Dispute Resolution Portal for resolving delayed payment disputes filed by Micro and Small Enterprises.

Objectives:

- To develop an Online Dispute Resolution mechanism for all the States and Union Territories (UTs) to address the issue of delayed payments faced by Micro and Small Enterprises.
- To promote digitization and digitalization and ensure uniformity and standardisation in the dispute resolution mechanism.
- To ensure speedier and cost- effective dispute resolution for Micro and Small Enterprises to enhance the financial strength and competitiveness of these enterprises.
- To promote containment of disputes through negotiation and mediation to make the dispute resolution process less adversarial.
- To ensure ease of access to justice for Micro and Small Enterprises and to reduce delays in the resolution of disputes.
- To make justice accessible to Micro and Small Enterprises in a vernacular language, thus making the processes more comprehensible.
- To facilitate the ease of administration of justice by increasing awareness about the legal rights of Micro and Small Enterprises.

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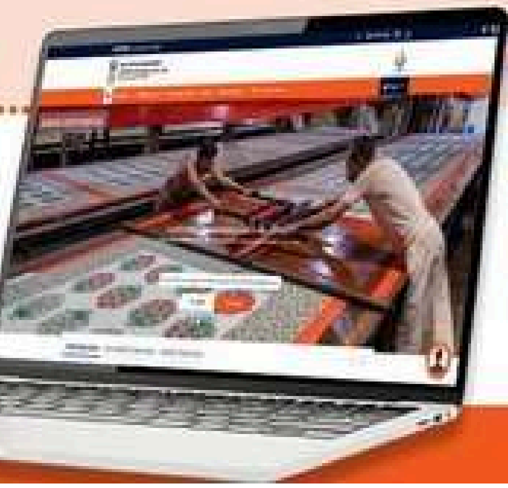

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DO YOU
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International
Cooperation Scheme
The International Cooperation (IC) Scheme by the Ministry of MSME helps Indian MSMEs take their businesses to the global stage. It promotes the export potential of small enterprises by providing opportunities to participate in international trade fairs, exhibitions, and buyer-seller meets, giving them a platform to showcase their products worldwide. The scheme also encourages technology collaborations, and provides capacity building support for first-time exporters, helping MSMEs enhance their competitiveness and expand into new markets.
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सत्यमेव जयते

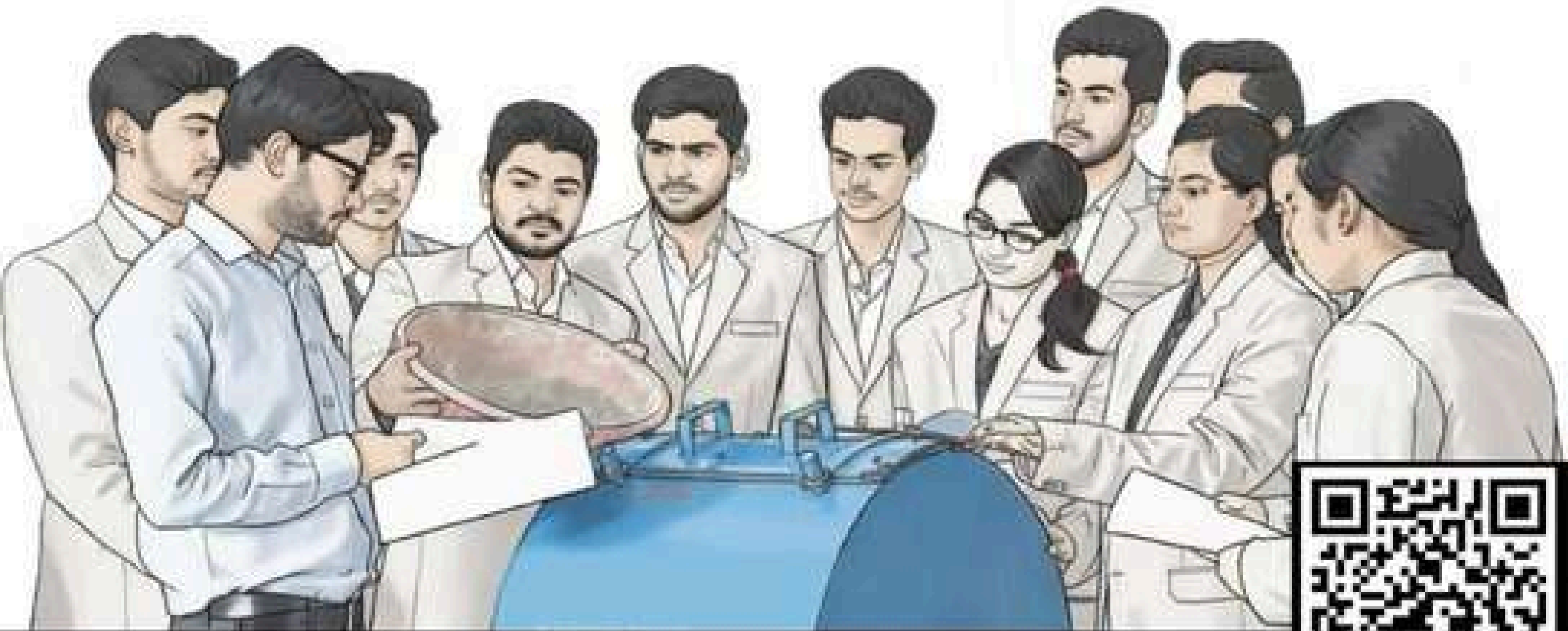
Entrepreneurship Skill Development Programme (ESDP)

- Motivates youth representing different sections of society, including SC/ST, women, differently abled, ex-servicemen, and BPL persons, to consider self-employment or entrepreneurship as one of the career options.
- Promotes new enterprises, builds the capacity of existing MSMEs, and inculcates entrepreneurial culture in the country.

Achievements

FY 2025-26 (From 1st April, 2025 to till date 12th February, 2026)

A total of **8,000** programmes have been conducted, benefiting **3,87,555** persons, under the scheme.



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MSME Champions Scheme

The objective of the MSME Champions Scheme is to select enterprises and modernize their processes, reduce wastages, sharpen business competitiveness, and facilitate their National and Global reach and excellence.

The Scheme has three components, namely,

- **MSME Sustainable (ZED) Scheme**
- **MSME Competitive (LEAN) Scheme**
- **MSME-Innovative (Incubation, Design & IPR) Scheme**

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MSME Champions Scheme

ACHIEVEMENTS

MSME Innovative scheme was launched on 10th March 2022 with 3 components, namely, Incubation, Design and IPR. Under the 'Incubation' component, 773 Host Institutes (HIs) have been approved which will nurture the development of innovative ideas approved through due selection process. Hon'ble President of India launched the MSME Idea Hackathon 5.0 (Smart and Sustainable MSMEs) on the MSME Day, i.e., 27th June 2025.

The Ministry has received **52,369 ideas under Hackathon 5.0.** Under the 'Design' component, **21 MoUs** have been signed - **01 IISc, Bangalore, 08 IITs, 12 NITs** as Implementing Agencies and **69 Professional Design/Student Projects** have been approved. Under the 'IPR' component, 191 Patents, 807 Trademarks, 99 Designs and 06 GI registration have been approved by Intellectual Property Facilitation Centre (IPFCs).

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MSME Champions Scheme

ACHIEVEMENTS

MSME Sustainable (ZED) Certification Scheme, launched on 28th April 2022, has witnessed significant progress during the year. A total of **2,71,373 MSMEs** registered under the scheme, and **1,92,689 enterprises were successfully certified — including 1,89,268 Bronze, 1,913 Silver, and 1,508 Gold certifications.** These certifications have supported enterprises in enhancing their quality, productivity, and overall competitiveness.

MSME Competitive (LEAN) Scheme, launched on 10th March 2023, has achieved notable traction during the year. A total of **32,077 MSMEs registered** under the scheme, with **31,987 MSMEs taking the Lean pledge.** Further, **7,394 MSMEs attained Basic Lean Certification, and 1,871 MSMEs were registered at the Intermediate level of the Scheme.**

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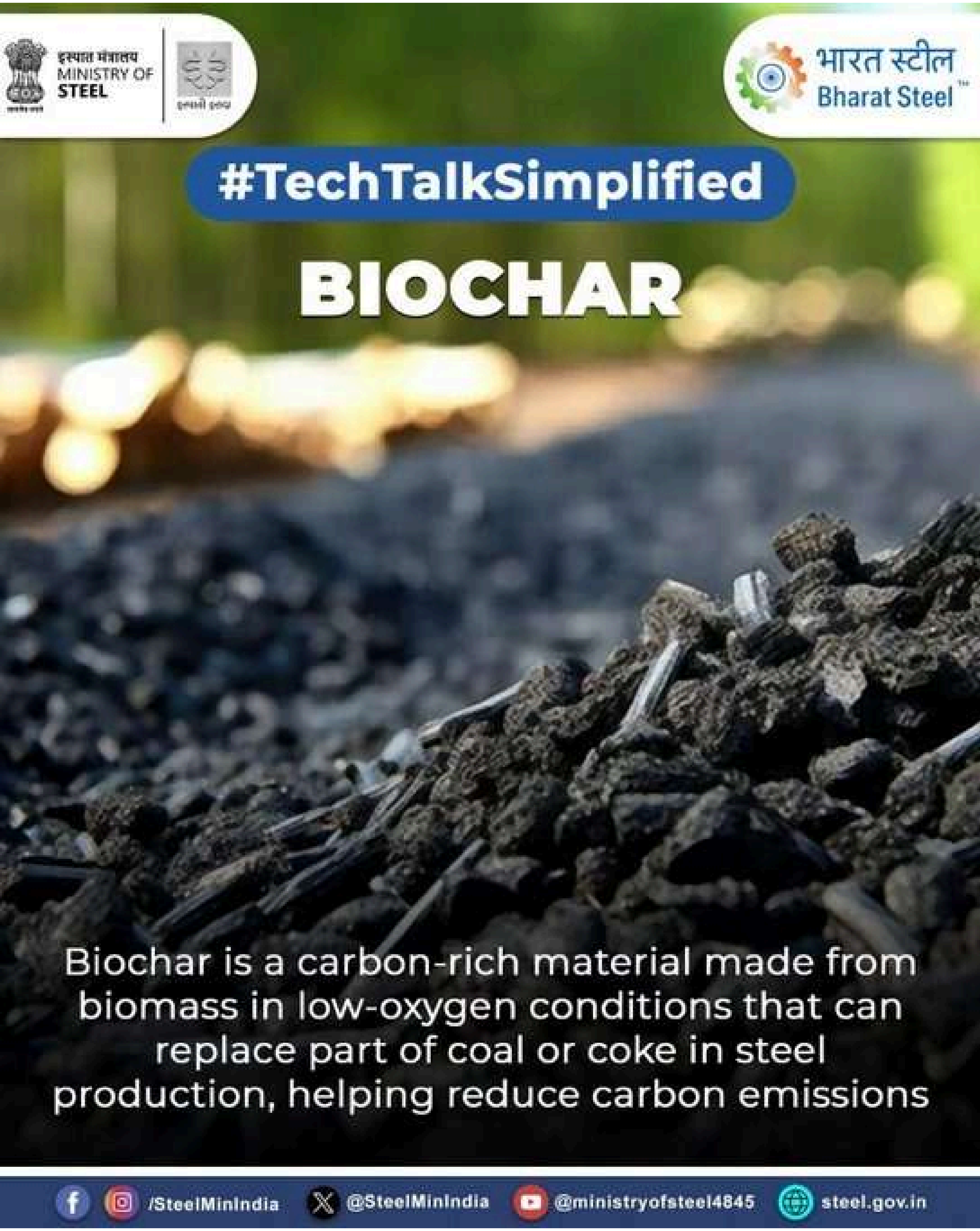
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Sl No.	Particulars	Location	prices	Remarks
1	Copper Armature Scrap, Cu 99%	Delhi	1,120,000	As on 20 Feb
2	Copper Armature Scrap,BME, Cu 98%	Mumbai	1,171,000	As on 20 Feb
3	Copper primary CC Wire rods (CCR),BME, 8 mm, Cu 99.99%	Mumbai	1,244,000	As on 20 Feb
4	Copper primary CC Wire rods (CCR), 8 mm, Cu 99.99%	Delhi	1,225,000	As on 20 Feb
5	Copper secondary CC Wire rods (CCR), 8 mm, Cu 99.99%	Delhi	1,190,000	As on 20 Feb
6	Ferro Manganese, HC 70%, 25-150 mm	Durgapur	73,500	As on 20 Feb
7	Ferro Manganese, HC 70%, 25-150 mm	Raipur	73,700	As on 20 Feb
8	Ferro Manganese,MC (Mn 70% min), 10-150mm	Durgapur	94,700	As on 19 Feb
9	Ferro Molybdenum (FeMo60%), Mo 60%, 10-100mm	Nagpur	3,760,000	As on 20 Feb
10	Ferro Silicon, FeSi 70%,25-100 mm	Guwahati	98,300	As on 20 Feb
11	GP 120 GSM, 0.6 mm	Mumbai	70,900	As on 19 Feb
12	GP 120 GSM, 0.6 mm	Chennai	73,500	As on 19 Feb
13	GP 120 GSM, 0.6 mm	Delhi	70,000	As on 19 Feb
14	GP 120 GSM, 0.6 mm	Hyderabad	72,200	As on 19 Feb
15	GP 120 GSM, 0.8 mm	Mumbai	69,400	As on 19 Feb
16	GP 120 GSM, 0.8-1.6 mm	Chennai	72,000	As on 19 Feb
17	GP 120 GSM, 0.7 mm	Delhi	68,500	As on 19 Feb
18	GP 120 GSM, 0.8 mm	Hyderabad	70,700	As on 19 Feb
19	HC Ferro Chrome (Low Silicon), HC 60%, Si -2%, 10-150 mm	Jajpur	129,000	As on 19 Feb
20	HC Ferro Chrome (Medium Silicon), HC 60%, Si-4%, 10-150 mm	Jajpur	123,000	As on 20 Feb
21	Melting Scrap ,CR Bushelling (Loose)	Ludhiana	37,800	As on 21 Feb
22	Melting Scrap ,CR Bushelling (Loose)	Mandi Gobindgarh	38,200	As on 21 Feb
23	Melting Scrap ,CR Bushelling (Loose)	Jalna	35,000	As on 21 Feb
24	Melting Scrap ,CR Bushelling (Bundle)	Chennai	34,700	As on 21 Feb
25	Melting Scrap ,CR Bushelling (Bundle)	Ahmedabad	35,300	As on 21 Feb
26	Melting Scrap, HMS (80:20)	Mumbai	33,500	As on 21 Feb
27	Melting Scrap, HMS (80:20)	Jalna	32,000	As on 21 Feb
28	Melting Scrap, HMS (80:20)	Alang	33,500	As on 21 Feb
29	Melting Scrap, HMS (80:20)	Raipur	34,000	As on 21 Feb
30	Melting Scrap, HMS (80:20)	Durgapur	35,400	As on 21 Feb
31	Melting Scrap, HMS (80:20)	Mandi Gobindgarh	34,200	As on 21 Feb
32	Nickel Cathode, BME, Ni 99.99%	Mumbai	1,585,000	As on 20 Feb
33	Pig Iron, Foundary Grade	Ludhiana	42,550	As on 20 Feb
34	Pig Iron, Foundary Grade	AHMEDABAD	44,000	As on 20 Feb
35	Pig Iron, Foundary Grade	Delhi	42,500	As on 20 Feb
36	Pig Iron, Foundary Grade	Durgapur	41,500	As on 20 Feb
37	Pig Iron, Foundary Grade	Kolhapur	43,200	As on 20 Feb
38	Pig Iron, Steel Grade	Durgapur	38,050	As on 20 Feb
39	Pig Iron, Steel Grade	Raipur	38,000	As on 20 Feb
40	Pig Iron, Steel Grade	Hyderabad	38,000	As on 20 Feb
41	Pig Iron, Steel Grade	Ludhiana	40,000	As on 20 Feb
42	Pig Iron, Steel Grade	Raigarh	38,900	As on 20 Feb
43	Tin Pure Ingot, BME, Sn 99.99%	Mumbai	4,372,000	As on 20 Feb

Metal China & Diecasting China & Nonferrous China 2026

06.05.2026-09.05.2026

NECC, Shanghai, China

CastForge 2026

09.06.2026 - 11.06.2026

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