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GREAT DIECASTING TECHNOLOGY FORUM

JOURNAL FOR ALUMINIUM CASTING TECHNOLOGY

Volume 66 - October 2024

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Improved Melt Quality for High Integrity Aluminium Castings

Critical melt treatment practice and melt quality analysis for Aluminium foundries

- Philippe KIENTZLER, International Marketing Manager, Foseco International LTD.
- Shrikant BHAT, Head Non-Ferrous Foundry, Foseco India

Cost saving in HPDC drossing with MTS 1500

Drossing is a key part of ladle treatment in Aluminium foundries. Globally, more than 50% of all Aluminium castings are now made using the High-Pressure diecasting process. Metal treatment is usually carried out in transfer ladles using simple degasers for 3 – 5 min. The purpose is not to degas the melt but to remove unwanted oxides and inclusions which will float up into the dross. These oxide films can lead to defects and casting failures. HPDC creates huge amounts of Aluminium dross which can be very rich in metallic Al droplets trapped within the dross.

Figure 16

Fig.16 shows the dross that was collected and sampled in a very large HPDC foundry making automotive castings. The standard dross is wet and heavy with Aluminium. While the dross collected after MTS 1500 is much lighter and poor in Aluminium.

Dross samples were sent to a specialized laboratory which analysed residual Al metal in the dross using a salt melting technique which is common in the industry.

Table 17 below shows the process comparisons between a Standard HPDC process and MTS 1500. We can see this foundry is able to save 136 Tonnes of Aluminium / year which leads to a saving of more than USD 250 K for the foundry.

Automotive HPDC foundry	Standard HPDC process	New MTS 1500 process
Ladle capacity (Kg)	1400	1400
Collected dross quantity (Kg)	4.7	3.5
Aluminium content (%)	86.4%	43.6%
Aluminium lost in dross (Kg)	4.06	1.53
Aluminium saved / ladle (Kg)	-	**2.53**
Number ladles / day	180	180
Number ladles / year	54 000	54000
Aluminium saved / year (Kg)	-	**136879**
Flux cost / year (USD)	-	$ 47250
Foundry savings @ LME price	-	**$ 253884**

Table 17

This saving led the foundry to invest into 2 MTS 1500 units Type Rotostativ in 2019.

VMET Principles [5] for Melt Quality Assessment in Al foundry

Vesuvius has developed a new technique [5] in order to evaluate metal quality in Al foundries. Upon collecting them, VMET samples need to be polished to a mirror finish and free of scratches as shown in Fig.18 below. Received samples are cut to fit in a 32 mm diameter sample cup. They are mounted in a heat set epoxy resin and polished using a polisher. Dust or fingerprints on the surface should be avoided as they will show up as contamination.

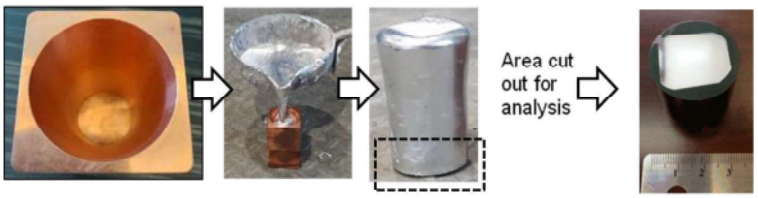
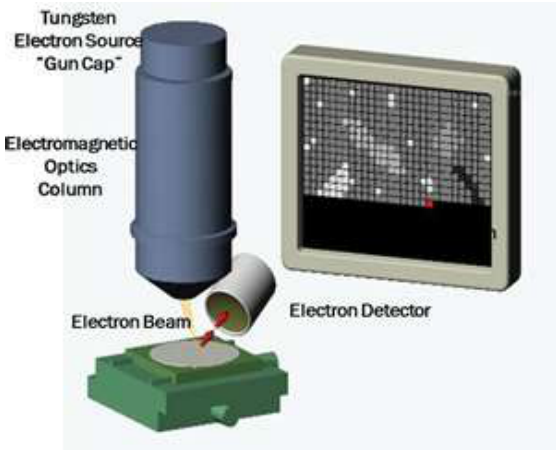


Figure 18

Micrograph images of polished samples are acquired using a Scanning electron microscope (SEM) - see Figure on the right.



mages are taken to provide a qualitative indication of the metal microstructure and porosity. Vmet analysis makes use of an automated SEM accompanied with an energy dispersive X-ray spectrometer (EDS) and also an attached software that is capable of classifying found features based on size, shape, chemistry and multiple other metrics as defined by the user.

The Aluminium sample will be scanned using SEM as shown on Fig.19 and an image analysis software will identify all Features > 0.5 µm in the sample. These features will be counted, measured and their chemical nature identified so that they can be classified as:

- Pores (gas or shrinkage)
- Oxide films
- Other non-metallic inclusions

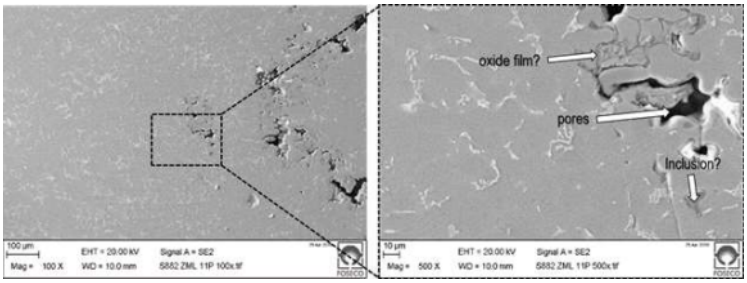


Figure 19

VMET will then generate a report where these features will be displayed by chemical nature and size in order to make interpretation easier. Depending on their respective sizes, these features can lead to defects in castings. Table 20 shows the example of Melt #1 which VMET finds to be a clean melt due to:

- All oxides and inclusions found are < 15 µm which is not a concern in foundry castings
- No oxides or inclusions were found > 15 µm which is a good indicator of melt quality
- 15 µm < Features < 75 µm is a concern for safety components and thin wall casting

- Features > 75 µm are indicative of very poor melt quality.

Feature size	Melt # 1	Explanation of Features	Comment
Area Analyzed (mm^2)	100	Area of sample analyzed	
Total Aluminum Oxides	18	*Sum of Aluminium & Mg Oxides*	
0.5 – 15 µm	18	Too small to give defects in castings	No concern
15 – 30 µm	0	Can reduce mechanical properties	Concern +
30 – 75 µm	0	A risk for all castings	Concern ++
> 75 µm	0	Very bad metal quality	Concern +++
Total Other Inclusions	48	*Sum of Other inclusions*	
0.5 – 15 µm	48	Too small to give defects in castings	No concern
15 – 30 µm	0	Can reduce mechanical properties	Concern +
30 – 75 µm	0	A risk for all castings	Concern ++
> 75 µm	0	Very bad metal quality	Concern +++

Table 20

VMET [5] assessment in European Wheel foundry

In the Last 20 years, Aluminium wheels have become the standard for OEMs around the world. The preferred manufacturing route for OEM wheels is Low Pressure Diecasting (LPDC) using A356 alloy which can meet the required OEM mechanical specifications after T6 heat treatment. But adequate melt quality is a key requirement which can often be tarnished by the excessive presence of porosity, shrinkage or oxides.

Some European wheel foundry asked us to conduct a melt quality audit using VMET to assess the quality of their ladle melt as melted and after various treatment processes.

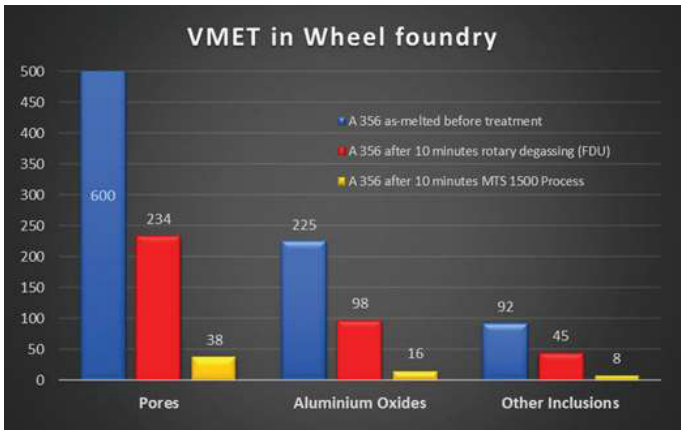
Fig.21 summarizes the VMET findings and clearly shows significant improvements as:

- The total number of features is reduced from 917 to 377 with FDU and to 62 after MTS
- Total Aluminium oxides reduce from 225 to 98 with FDU and to 16 after MTS
- Total Other inclusions also reduce from 92 to 45 with FDU and to 8 after MTS
- Σ of features > 15 µm are greatly reduced from 137 (as melted) down to 3 after MTS.

Foundry	VMET Features explanation	European Aluminium Wheel foundry		
Alloy		Al-Si7%-Mg0,3% (A356)		
Sample Description		A356 alloy as melted	After 10 min Rotary degassing (FDU)	After 10 min MTS 1500 treatment with MTS 1524
Total Features	Total # of defects porosity & inclusions	917	377	62
Features by Nature & Chemistry				
Pore	Gas and shrinkage porosity	600	234	38
Aluminium Oxides (Al2O3)	Aluminium Oxide & Mg Spinels	225	98	16
Other inclusions	Other inclusions (carbides, refractory...)	92	45	8
Features and inclusions By Size				
0.50 – 15.0 µm	Defects size – little significance in castings	780	368	59
Σ all features > 15.0 µm	Defects size – concern in castings	137	9	3

Table 21

VMET analysis is showing that MTS 1500 has a significant impact on melt quality in wheel foundries by reducing unwanted defects like porosity, oxides and other non-metallic Inclusions as shown in Graph 22. This trend has led to a strong development of MTS 1500 use in wheel foundries around the world.



Graph 22

VMET assessment of intermetallic inclusions in HPDC foundry

More than 50% of all Aluminium castings are now made using the High-Pressure diecasting process in the world.

Metal is usually transferred from the melting to the casting furnaces using transfer ladles with capacities ranging from 300 Kg up to 1500 Kg. During this melt transfer, some metal basic metal treatment is performed using rotary degassers for 3 – 6 min.

The purpose is not to remove hydrogen but unwanted oxide films and inclusions that can lead to defects and casting failures.

Fig.23 shows a typical transfer ladle undergoing metal treatment using MTS 1500 Rotostativ with following attributes:

Figure 23

- Casting: Automotive transmission
- Alloy: ADC12 secondary ingot
- Flux addition: 0.03% Coveral MTS 1565
- Rotor XSR 220.70 + DSK 75/800.70
- Ladle capacity: 1400 Kg
- Treatment time: 3 min only

This automotive foundry asked to evaluate their Melt Treatment practice using VMET on several transfer ladles prior to filling the casting furnace. Fig.24 shows the VMET results before and after MTS 1500 treatment in the transfer ladle.

Ladle	Ladle # 1		Ladle # 2		Comments / Explanation
Sample from ladle	Before	After	Before	After	
RPT density (g/cc)	2.27	2.62	2.25	2.61	Fit for purpose degassing improvement
Total Features	1973	296	243	70	Overall reduction of Total Features ↘
Total Aluminum Oxides	1683	253	205	63	Overall reduction of Oxide presence ↘
0.5 – 15 µm	1682	253	205	63	Little significance in casting
> 15 µm	1	0	0	0	Reduction of oxides ↘
Total Other Inclusions	290	43	184	7	Overall reduction of inclusions ↘
0.5 – 15 µm	285	43	183	7	Little significance in castings
> 15 µm	5	0	1	0	Reduction of inclusions ↘ ↘

Figure 24

In the case of both ladles, the VMET Analysis found:

- an overall reduction of total # Features, Oxides and Inclusions.
- the oxides and inclusions larger than 15 µm were completely eliminated
- the Fe-linked intermetallic components that can be present in HPDC alloys were reduced significantly.

VMET shows a clear impact of MTS 1500 process on melt quality in HPDC.

VMET assessment of Magnesium oxides in an Automotive piston Foundry

Figure 25

Aluminium Pistons have become the norm in the automotive industry due to their relative strength vs light weight. But to achieve such performance, pistons must be free of porosity, oxides & inclusions as well as unwanted alkali elements like Na or Ca which at levels > 5 ppm will affect mechanical properties.

One additional issue are the Magnesium oxides forming in the melt due to the high Mg content of eutectic piston alloys like ACA8-336-LM13.

Hence, particular care is given to metal treatment which includes the use of rotary degassers with injection or addition of various fluxes or gases designed to remove such impurities. Chlorine gas (Cl2) or chlorine releasing fluxes (C2Cl6) are still used in some parts of the world, but they are no longer perceived as the most environmentally friendly technology. As can be seen below, there are often strong chlorine emission linked with the use of such toxic additives.

- C2Cl6 + [Na] =>NaCl + Cl2 gas ↗
- C2Cl6 + [Ca] => CaCl2 + Cl2 gas ↗

Due to environmental pressure, a new MTS 1500 technology (Fig.25) has emerged in pistons which combines the use of Rotary degassing using inert gases (Ar, N2) and several types of fluxes which have multiple functions like to:

1. remove oxides and especially MgO (spinels) which are detrimental to piston quality
2. reduce all alkali elements like Na & Ca below 5 ppm

Coveral MTS 1565 has been proven to effectively remove oxides and particularly MgO spinel inclusions in an environmentally acceptable manner.

While Coveral MTS 1591 can effectively remove unwanted Alkalis according to the following mechanism: Coveral MTS 1591 + [Na] + [Ca] => NaCl + $CaCl_2$ (which will float into the dross)

A market leading automotive piston foundry has asked us to use VMET to investigate their melt quality following a customer complaint linked to MgO inclusions.

Table 26 below shows the VMET report and findings Before and After metal treatment. This VMET analysis was able to identify the presence of:

- excessive amounts of Na & Ca in the melt before treatment
- many small oxides and inclusions in the melt prior to rotary degassing treatment
- 26 MgO spinel inclusions in the sample, smaller than 15 µm
- 3 MgO spinel were found to be larger than 15 µm - a real problem for pistons

VMET also showed that MTS 1500 process together with Coveral MTS 1565 cleaning flux was able to significantly improve melt quality by removing all oxides and MgO inclusions > 15 µm.

This VMET work led to the sales of several MTS 1500 units in this piston foundry.

Piston Foundry	**MTS 1500 Process with Coveral MTS 1591/1565**		
Trial	**500 Kg Crucible**		
Sample location	**Before**	**After**	**Explanation**
Na (ppm)	4	0.1	Excellent Alkali removal
Ca (ppm)	7.9	2.6	Excellent Alkali removal
Density Index (%)	7.5	0.1	Fantastic degassing perfomance
Total Aluminum Oxides	64	200	
0.5 – 15 µm	64	200	Breaking up of clusters - not a concern
Σ all oxides > 15 µm	0	0	No oxides found
Total Other Inclusions	69	74	
0.5 – 15 µm	66	74	Breaking up of clusters - not a concern
Σ all inclusions > 15 µm	**3**	0	**Reduction of inclusions ↘↘**
Total MgO & Spinels	29	5	
0.5 – 15 µm	26	5	Reduction of spinels
Σ all MgO > 15 µm	**3**	0	**Reduction of spinels ↘↘**

Figure 26

VMET Assessment of Chip melting operation for Foundry ingot production

In recent years, many operations have looked at remelting machining chips in order to produce secondary ingots suitable for Aluminium casting production. This is particularly true in Asia for very large amounts of A356 chips coming from LPDC wheel machining.

But many such operations encounter quality issues as they underestimate the level of oxides created during the remelting of such finely divided chips which have large specific surfaces. Hence extreme oxidation will create millions of very fine oxide films as shown in Fig.27 where VMET found extremely high levels of oxide between 0.5 µm – 15 µm.

Such high levels of oxides will create excessive dross during melting but also aggregate to form larger oxide clusters & films which are the cause of reject castings.

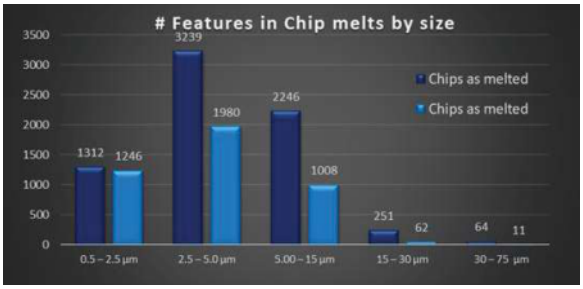


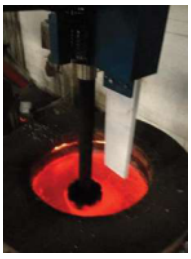
Figure 27

Such chip generated melts must undergo intense metal treatment in order to reduce the level of oxides significantly. Strong cleaning fluxes should be applied to de-wet the oxide films and make sure they can be floated into the dross.

One secondary ingot maker asked us to implement such a metal treatment and use VMET to quantify the level of oxides and the improvement observed.

Fig.28 shows the fuel fired crucible furnaces that are used to remelt 100% charges of A356 chips. The melting temperature exceeds 780°C. The crucible capacities are 1 Tonne of chips. Foseco implement our MTS 1500 type Mark 10 mobile device able to treat up to 5 furnaces.

Figure 28



VMET Samples were taken from one chip melting furnace before and after a 10 min MTS 1500 treatment. The SEM pictures with 100x magnification are shown in Fig.29.

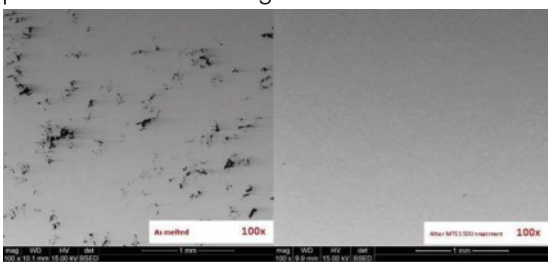


Figure 29

We can see the melt "as melted" shows many defects which are a mixtures of porosity and oxide films. Whereas after the 10 min MTS 1500 treatment, the sample is clean without any visible traces of oxides. This is a visual confirmation that MTS 1500 process is able to achieve good melt quality even with 100 pure chips.

Two furnaces # 1 & #2 with similar capacity were loaded with the same amount of chips. After a melting time of around 1 hour, the MTS 1500 unit was applied respectively to furnace 1 for 15 min and furnace 2 for 10 min.

All other working parameters were kept identical including:

- Furnace capacity: 750 Kg chips
- Gas flow: 20 l/min
- Flux addition: 1.2 kg (0.16%)
- Rotor Size: XSR Φ 220 mm
- Shaft length: 900 mm
- Treatment temperature: 720°C

Chip melting	Furnace 1		Furnace 2	
Sample location	Chips as melted	After 15 min MTS	Chips as melted	After 10 mn MTS
Total Features	7116	73	4307	53
Total Pores	3804	63	3791	29
Aluminium Oxides	**2958**	3	**329**	19
Other Inclusions	**354**	7	**187**	5
0,5 – 2,5 µm	1312	9	1246	17
2,5 – 5,0 µm	3239	21	1980	18
5,00 – 15 µm	2246	21	1008	11
15 – 30 µm	251	19	62	3
30 – 75 µm	64	2	11	4
> 75 µm	4	1	0	0

Figure 30

The VMET results in Fig.30, clearly show that MTS 1500 treatment was able to reduce:
1. Total # features from 7116 & 4307 down to 73 & 53 respectively.
2. Total # pores from 3804 & 3791 down to 63 & 29 respectively.
3. Total # oxides from 2958 & 329 down to 3 & 19 respectively.
4. Total # other inclusions from 354 & 187 down to 7 & 5 respectively.

From this chip melting case, we can conclude that the MTS 1500 process is able to remove more than 98% of all defects in Aluminium castings.

Conclusions:

Metal treatment is one of the critical parts of the foundry process, which often has a significant impact on casting quality, reject rates and costs. Existing practice may have limitations in terms of quality, efficiency or automation.

MTS 1500 process clearly demonstrated a higher efficiency of Na modification in sand and gravity as well as better grain refining both in gravity and LPDC wheels'

In High Pressure Die Casting, MTS 1500 showed significant cost savings in terms of less dross generation.

Finally, MTS 1500 together with VMET Melt Quality Assessment has clearly proven that it can significantly improve melt quality in Aluminium pistons, wheels and chip melting, by removing detrimental oxides and inclusions.

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He has contributed in upgrading of the Rotary Metal Treatment Station to eliminate the drawbacks and provide consistent metal quality, with improved productivity. In this paper, the author explains some of the salient points.

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Growing Need for Medical Grade Diecasting

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The medical industry is evolving and enhancing at a very fast rate. Medical devices are capable of addressing issues that were unimaginable a few years back. Today, one sees medical innovations where traditional methods make way to new approaches. Device manufacturers have to pay close attention to the consumer electronics industry but also have to evaluate to develop newer medical equipment that is challenging and technologically complex. In this age of nanotechnology, miniaturization has an important role to make innovative medical equipment which addresses human error, patient safety and clinical needs. Even though the medical manufacturing industry could achieve numerous technological milestones, there are still constraints to meet the increasing demands globally.

The growing demand for die cast products is due to the following reasons:

- Demand for more personalized and advanced treatment.
- Ageing population.
- Increased availability of healthcare.
- Better efficiency of diecast products.
- Extremely high speed of production.
- Increase in device recalls. This will urge manufacturers to actively engage in testing and equipment validation to improve quality.

Surgical Equipment

These are the tools used for performing various surgical tasks. Traditionally machined Aluminium and stainless steel were used due to restrictions from the medical board. Now a variety of metals are used for die casting medical equipment. Using surgical equipment made out of Aluminium or Zinc die-casting makes it possible to manufacture highly efficient and long-lasting surgical instruments. It must be noted that the amount of cost that can be saved as well. Several surgical types of equipment can be manufactured using or Aluminium or Zinc die casting, such as retractors, forceps, scissors, clamps, files, drills, bone saws etc.

Diagnostics and Therapy

The days are gone when the patient had to be put under a big X-ray machine.With the advancement in die casting technology, it is possible to produce compact and efficient diagnostic equipment. State of the art methods like double-sided die casting equipment that are effective, and with a high level of sophistication can be developed.

Medical Electronic Equipment

Due to innovation in biomedical engineering, the electronic components designed for various biomedical applications are getting increasingly sophisticated. The electronic equipment is susceptible to radiations and changes in temperatures. If the system overheats, the chances are that the internal circuitry will get burned off. Due care must be taken to not overheat beyond a certain extent or get exposed to radiation. This is achieved by the use of a high-performance heat sink. With modern die-casting technology, it is possible to integrate high-performance heat sinks within the product design.

Benefits of Die Casting for Medical Equipment

- Cost-effective production
- Tight tolerances possible
- Durable cast housings
- Recyclable
- Cost-effective
- Minimal draft angles on internal features
- Less machining needed as compared to other manufacturing methods
- Heat sink can be integrated within the product
- Consistent quality
- Uniformity of parts
- Complex structures can be made
- Good strength and dimensional stability
- Casts with thinner walls possible with light tolerances
- High-speed production

Medical Equipment made using Aluminium Die Casting.

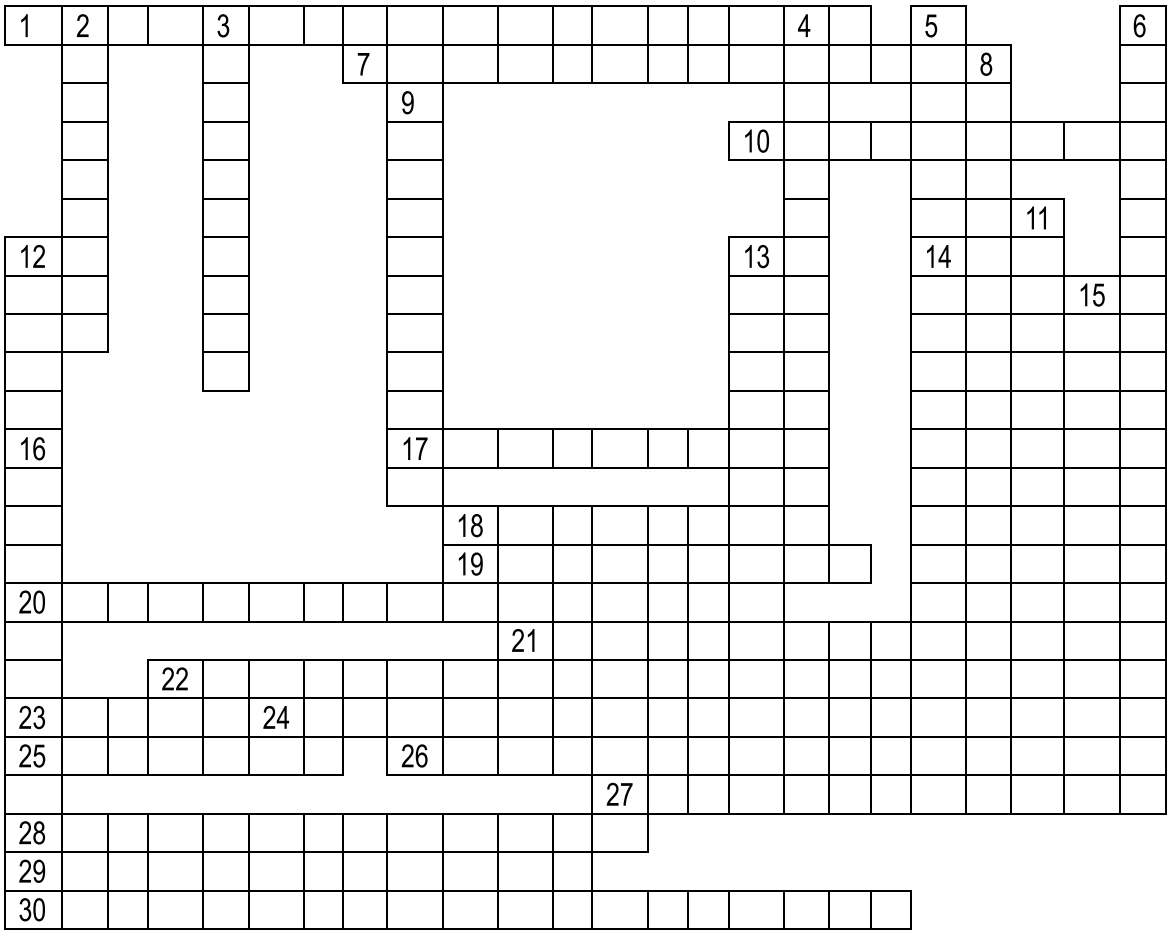
- Trays
- Tubes for diagnostic equipment
- Seat lifts
- Monitoring devices
- Wheelchairs
- Crutches, other aids
- Cases
- Containers/Organizers
- Stethoscopes

Aluminium alloys offer corrosion resistance and better strength to weight ratio, making them desirable for medical device components. A360 and A380 aluminium is usually used for casting medical devices and equipment.

The developments in the die casting industry have entirely revolutionized the way medical equipment is manufactured. Now it is possible to manufacture highly complex and intricate devices that were not possible in the last decade.

GDCTech Crossword #5, The Cue: Heat is ON

Compiled by: Pramod Gajare (Consultant) pramodgajare2013@gmail.com



Clues Along:

1) A graph of temperature, pressure and composition limits of phase fields in an alloy system as they exist under conditions of thermodynamical equilibrium

7) A graph showing relation between time and temperature during cooling of material; that is used to find the temperatures at which phase changes occur

10) In a phase diagram, locus of points representing temperatures at which various components begin to freeze during cooling or finish melting during heating

17) Aging under conditions of time and temperature than those required to obtain maximum change in a certain property

18) As cast condition

19) Contraction that occurs when metal cools from liquid to solid and in cold state from solidification to room temperature

20) The _____ _____ curve is produced by plotting time against temperature

21) Heating to an excessively high temperature as a result of which the properties or structure undergo modification

22) Process by which a metal object is cooled from an elevated temperature in a manner that avoids hardening, cracking or internal damage

23) A change in metallurgical structure of an alloy over period of time following casting which affects properties and dimensions

24) The temperature range between liquidus and solidus temperatures in which molten and solid constituents coexist

25) A _____ _____ stress is induced in a material when temperature change causes a force trying to change the size or shape of the part

26) Coefficient of ____ _____ is a numerical value of unit change in length of a substance with each degree of temperature change

27) The temperature at which the pure metal, compound or eutectic changes from solid to liquid

28) The lowest temperature at which the liquid phase is stable at a given pressure

29) Aging that occurs at room temperature

30) Coefficient of _____ _____ is the ratio at which a material will transfer heat energy per unit time through a distance due to a temperature difference

Clues Across:

2) Rapid cooling of a metal from elevated temperature

3) With input of this heat, the temperature of recipient body does not increase

4) A low temperature heat treatment generally applied to stabilise properties.

5) In a phase diagram the locus of points representing temperatures at which various components finish freezing on cooling or begin to melt on heating

6) Heating an alloy at suitable temperature for sufficient time to allow soluble constituents to enter into solid solution and then cooling rapidly enough to hold the constituents in solution

8) A method of heating in which an alternating current and coil are used to create a secondary current within the metal causing heat to be generated

9) The common part in all types of fossil fuels ranging from coal to gas

11) A change in phase occurs at ____ temperature

12) Volumetric increase of a casting as a result of aging

13) Average slop of time temperature curve over a specified time and temperature interval

14) Heating molten metal to a temperature above the normal casting temperature to obtain more complete refining or greater fluidity

15) An imprecise term for various quenching procedures in which a quenching medium is maintained at a prescribed temperature above 70 degrees centigrade

16) Heating and cooling of casting to controllably alter material properties

FURNTECK

EFFICIENT | ECONOMICAL | RELIABLE

Furnteck's most trusted
Tower Melting Furnace
is **now**
Extra Efficient

Energy consumption
<575 KWH/TON **@ 53** LTRS/Ton of F.O.

with METAL YIELD of
>99.4%

HIGH **Quality**
METAL

LOWER GAS
INCLUSION

Complete Solution for Aluminium Industry under one roof

Direct Bale Out Type

Electrical Holding (Crucible)

Top Heated Holding

Ladle Preheater

Kattle Type
Transfer Laddle

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Email: response@furnteck.com | **Website:** www.furnteck.com

ENERGY SYSTECH

ALUMINIUM FURNACES

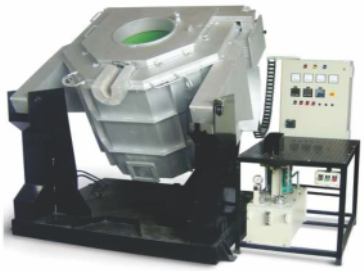
Sklenar-type Melting Furnace

"Bulk Melting solutions"

Salient Features:

- Rugged construction with smooth & jerk-free tilting.
- Efficient combustion system.
- Easy charging of material into the furnace.
  Manual or Skip Hoist type.
- Easy dross cleaning.
- Long refractory life.
- Rapid & economical melting.
- Low melt loss.

Electrical Stationary Furnaces



Electrical Hydraulic Tilting Furnaces

Nitrogen Degassing Machine (auto)

Density Index Unit

Other Products for the Aluminium Industry

- Electrical Furnaces (Crucible)
- Fuel Fired Furnaces
- Electrical & Fuel Fired Tilting Furnaces
- Heat Treatment Furnaces
- Rotary Degassing Unit
- Density Index Unit

ENERGY SYSTECH

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GDCTech Crossword #4
The Cue: Patterns, moulds, and dies

Solution to GDCTech Crossword #4 - Ref: August 2024 Issue

M	A	T	C	H	P	L	A	T	E	J	E	C	T	O	R	P	I	N	
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C	U	F	A	C	I	N	G	S	A	N	D	R	A	G	A	E	I	T	D
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NEWS

TRAINING PROGRAMMES & QUIZ COMPETITION - CHENNAI & COIMBATORE

Two Days Training Programme On Melting & Metal Treatment and Metallurgy of Aluminium Cast Alloys at Chennai, held on 27 - 28 August 2024
Faculty Mr. R. V. Apshankar
Quiz competition was also held on 27th August at the same venue. Four teams participated and the winner was **ENDURANCE TECHNOLOGIES LIMITED**

Two Days Training Programme On Melting & Metal Treatment and Metallurgy of Aluminium Cast Alloys at Coimbatore, held on 30 - 31 August 2024
Faculty Mr. R. V. Apshankar & Dr. J. Anburaj
Quiz competition was also held on 30th August at the same venue. Four teams participated and the winner was **SKYFAST**

MINDA INDUSTRIES LTD.

(Alloy Wheel 2W Division)

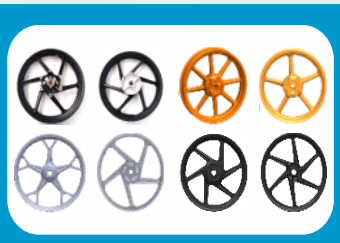
- FIFO at all stages of production cycle.
- Single piece flow
- Unidirectional flow
- Minimised Material Handling.
- Raw material to finished product in one shed
- Casting movements only through conveyers or AGVs.
- Flexible production set-up for variety of models
- Training room / DOJO room for operators Training
- Implementation of Industry 4.0

- Minda Industries Ltd has set up fully integrated manufacturing facility for Alloy wheel 2 wheeler.
- Facilities include state of art infrastructure for Foundry, Machining and Painting (Powder Coating & Liquid Painting) providing one stop solution
- Flexibility to manufacture a variety of sizes (range 10-19 Inches) & surface coats
- Location: Supa Industrial Area- 86 KM from Pune Airport
- Land: 20 acres
- Built-up: 24000 sq. mtr.
- Capacity: 4 Million Wheels p.a. , expandable up to 6 Mn

Robotic CNC Cells

Smart Conveyers

Auto Storage System



Product Portfolio

AGVs

CNC Robot

Pouring Robot

GREAT DIE CASTING TECHNOLOGY FORUM

GDCTECH 2024

CONFERENCE & EXHIBITION

Smart Factory for Sustainable Growth

19-20 (Thu-Fri) September 2024 | The Pride Hotel, Pune - 411005

Lighting the lamp

Chief Guest **Mr. Shripadraj R. Ponkshe,** General Manager, Head Materials Engg -Product Circular Economy Engg Research Center, TATA MOTORS LTD

Guest of Honor **Mr. Ajay Tannu,** Executive Director, OMR BAGLA AUTOMOTIVE SYSTEMS INDIA LTD.

Keynote Speech **Mr. Snehasis Batabyal**, Partner – Business Consulting, KPMG ASSURANCE AND CONSULTING SERVICES LLP

Release of Publication

Valedictory Chief Guest **Mr. Viren Joshi,** Chairman, ODYSSEY AVENUE PARTNERS PVT. LTD., Ex. Vice Chairman & Global CEO, Sigma Electric

Audience

Panel Discussion 1
BUSINESS STRATEGIES FOR GROWTH

Strategy and Growth was the first Panel in the two day Conference and the enlightened discussions set tone for the entire Conference.

Panel was well balanced with Digital Transformation Expert Dr. Arvind Tilak in the Chair, 2 entrepreneurs, 2 expert consultants and 1 quality practitioner.

Dr. Tilak opened the discussions with overview of macro picture and how India as a country and Indian aluminium sector as a whole are set to benefit from the Opportunity. He mentioned that this is a historic moment in the history of nation and industries and all of us need to make most of it.

Each Panel member contributed to the discussions by sharing their personal growth stories and strategies and plans they have adopted to grow and sustain. Each of the story brought out unique and distinguishing aspects of growth strategies that can be immolated by other companies.

Overall it was a great discussion and there was excellent feedback on overall discussions and approach.

Moderator
Dr. Arvind Tilak
CEO, ASCENT INTELLIMATION PVT. LTD.

Panel Discussion 2
SUSTAINABILITY IN DIE CASTING INDUSTRY

Report: Sustainability and Smart Manufacturing Technology in the Die Casting Industry

1.Index
2.Introduction
3.Segments
3.1.Segment A: Supply Chain and Circular Economy

- Supply Chain Optimization & Circular Economy
- Challenges in transitioning supply chains
- Adoption of closed-loop systems in aluminum die casting
- End-of-Life Management for sustainability

3.2.Segment B: Decarbonization and Sustainability Initiatives
▪Initial steps for decarbonization
▪Importance of tracking and documentation
▪Investment opportunities in sustainable practices

3.3.Segment C: Integrating Sustainability into Management Systems
▪Integrating sustainability into ISO standards (14001 & 9001)
▪Lean Six Sigma tools for waste and energy reduction

3.4.Segment D: Practical Sustainability Practices and Compliance
▪Shop floor sustainability practices
▪Data utilization for efficiency
▪Importance of regulatory compliance

3.5.Segment E: Safety, Energy Efficiency, and ESG Practices
▪Safety hazards in die casting
▪Energy optimization
▪Role of ESG practices in sustainable manufacturing

4.Key Takeaways:
▪1. Supply Chain & Circular Economy
▪2. Decarbonization
▪3. Management System Integration
▪4. Practical Steps & Compliance
▪5. Safety, Energy, & ESG Practices

Introduction
The GDCTECH panel discussion delved into the integration of sustainability and smart manufacturing technologies in the die casting sector. Experts from various fields shared their insights on several crucial topics, including the optimization of supply chains to reduce waste and improve efficiency, as well as strategies for achieving decarbonization in manufacturing processes. The discussion also highlighted the importance of incorporating sustainability into existing management frameworks, such as ISO standards, to ensure a structured approach to environmental responsibility. Additionally, the panelists addressed practical measures for implementing sustainable practices on the shop floor, demonstrating how innovation and sustainability can drive progress in the die casting industry.

Segments
Segment A: Supply Chain and Circular Economy
Panelist: Mr. Uday Gupta, Eco E-market Center for Responsible Business
Mr. Uday Gupta emphasized the role of supply chain optimization in advancing circular economy initiatives within the die casting industry. Key points discussed:

- **Supply Chain Optimization & Circular Economy:** Businesses are increasingly recognizing the need to transition from a linear to a circular economy model. Supply chain optimization helps minimize resource usage and promotes recycling and reuse.
- **Challenges:** The primary challenges involve redesigning supply chains to align with circular economy goals and overcoming resistance to change.
- **Examples:** Companies in the aluminum die casting industry are adopting closed-loop systems where recycled materials are used, reducing the demand for raw resources and minimizing waste.
- **End-of-Life Management:** Effective management of products at the end of their lifecycle can significantly support both supply chain efficiency and sustainability objectives.

Segment B: Decarbonization and Sustainability Initiatives
Panelist: Mr. Milind Saindane, Instron Technologies
Mr. Milind Saindane focused on decarbonization, and the steps companies should take to evaluate and enhance their sustainability efforts:

- **Initial Steps:** Companies should begin by assessing their current carbon emissions and identifying areas where reductions can be made, such as through energy efficiency and process optimization.
- **Tracking & Documentation:** Properly documenting decarbonization initiatives is essential for tracking progress and ensuring accountability.
- **Investment Opportunities:** Sustainable practices often present long-term financial benefits, particularly through energy savings and waste reduction. Mr. Saindane highlighted that investing in decarbonization can also improve a company's market competitiveness and reputation.

Segment C: Integrating Sustainability into Management Systems
Panelist: Mr. Pravin Halkikar, QLSS Business Consulting
Mr. Pravin Halkikar explored the integration of sustainability goals into existing management systems:

- ISO Standards: Die casting companies can integrate sustainability into their ISO 14001 Environmental Management System (EMS) and ISO 9001 Quality Management System (QMS). Challenges include ensuring these systems are adaptable and align with sustainability objectives without disrupting core operations.
- Lean Six Sigma Tools: Examples were provided of how Lean Six Sigma methodologies have been applied to reduce waste and optimize energy use in the die casting industry, contributing to sustainable manufacturing.

Segment D: Practical Sustainability Practices and Compliance
Panelist: Mr. Nilesh Shedge, Carbon Minus
Mr. Nilesh Shedge focused on practical steps companies can take to adopt sustainable practices:

- **Shop Floor Practices:** Initiating sustainability on the shop floor involves small, actionable steps like energy conservation, waste reduction, and resource efficiency. These can have an immediate impact on reducing the environmental footprint.
- **Data Utilization:** Using data to analyze and improve operations can significantly enhance sustainability efforts by identifying inefficiencies in energy and resource usage.
- **Compliance:** Emerging national and international standards will soon place greater pressure on businesses to adopt sustainable practices. Mr. Shedge stressed the importance of staying ahead of these regulations to maintain business continuity.

Segment E: Safety, Energy Efficiency, and ESG Practices
Panelist: Mr. Pankaj Kadam, Vitesco Technologies India Limited
Mr. Pankaj Kadam addressed safety, energy efficiency, and the adoption of Environmental, Social, and Governance (ESG) practices in die casting operations:

- **Safety Hazards:** Common safety hazards in die casting include exposure to molten metals and high-pressure systems. Ensuring a strong safety culture through training and behavioral changes can mitigate these risks.
- **Energy Optimization:** Comparing different energy sources and adopting more efficient systems can significantly reduce the carbon footprint of manufacturing operations.
- **ESG Practices:** Mr. Kadam outlined the growing importance of ESG frameworks and how they help align business strategies with environmental sustainability, employee well-being, and ethical governance.

Brief Conclusion Report: Sustainability and Smart Manufacturing Technology in the Die Casting Industry
The panel discussion hosted by GDCTECH explored the integration of sustainability and smart manufacturing technologies in the die casting industry. Key insights were shared on supply chain optimization, decarbonization, management systems, and the adoption of sustainable practices.
Key takeaways from the discussion include:
1. Supply Chain & Circular Economy: Transitioning to a circular economy is essential for sustainability. Optimizing supply chains to reduce waste and improve recycling is crucial for environmental and economic benefits.
2. Decarbonization: Companies should prioritize carbon reduction through energy-efficient practices and effective documentation of sustainability efforts. Investments in decarbonization can lead to significant returns.
3. Management System Integration: ISO standards like ISO 14001 and ISO 9001 can incorporate sustainability goals, while Lean Six Sigma tools help reduce waste and energy use.
4. Practical Steps & Compliance: Implementing sustainability on the shop floor through resource efficiency and data analysis is practical and impactful. Businesses should stay ahead of emerging regulatory standards to ensure compliance.
5. Safety, Energy, & ESG: Enhancing safety culture and adopting energy-efficient systems can improve sustainability. The role of ESG practices is growing in driving green manufacturing.
Overall, the panel emphasized the critical role of sustainability in shaping the future of the die casting industry, driven by innovation, environmental responsibility, and regulatory compliance.

Moderator
Mr. Manoj Singh
Dy. General Manager - Advanced Technology Center, SIGMA ELECTRIC MANUFACTURING CORPORATION PVT. LTD.

Panel Discussion 3
DIE CASTING TECHNOLOGIES IN NEW MOBILITY

The topic was relevant from the perspective of the changes happening in the Auto-Component Industry at large and the Die Casting Industry in particular, due to the onset of the New mobility / Future of Mobility transition.

New Mobility is not just about Battery Electric Vehicles (BEVs) only and it has a wider gamut of technologies – Hybrid Electric Vehicles (HEVs – Micro, Mild, Plug-in / Pure / Full), Fuel Cell Electric Vehicles (FCEVs) and Alternate Fuel ICE Vehicles (CNG, Ethanol, H2ICE, etc.). The Future of the Mobility ecosystem is about the coexistence of all of these technologies. It is evident that the IC Engine is not vanishing at least for the next 2 decades and with the increased focus on light-weighting across all the OEMs, it only augurs well for the Die casting Industry. The CAGR for the Die Casting Industry is estimated to be above 7% for the next few years.

With the OEMs at the helm driving the transition, Cost, Quality and Delivery are hygiene and it will only become more critical in the future and challenges do exist at various levels across the supply Chain on QCD which will warrant increased focus from the Suppliers. However this transition also presents an additional set of challenges for the future – Recyclability, Carbon Footprint, and Suppliers' involvement in design & value addition. This also leads to emphasis on specific areas like focus on emerging technologies like Runner-less Castings, 3D Printing, or even Gigacastings (even if it is still very premature on the Technology Adoption Curve).

Having said that, the Supplier-end Challenges are certainly not to be overlooked. Most of the suppliers, especially the micro and small companies are short on bandwidth and are not able to attract talent. On the top of this, with every passing year, there is an acute shortage of talent in the Industry as far as core-technical areas like Metallurgy are concerned. This puts the suppliers between a rock and a hard surface and they are limited to just being manufacturers with a part-to-print agenda and hinders their ambitions to become a Design & Development oriented firm. The capabilities of the Indian ecosystem on Tooling design & development are also far from desired. While the OEMs, in all fairness, expect a certain level of rigour from the Suppliers on Quality Management, Problem Solving, Process Capability Improvement, and all other related aspects, the suppliers genuinely fall short on capabilities and bandwidth on these aspects as well.

The OEM representatives on the panel did emphasize that they have been open and generally opined that the OEMs should be open to receiving any such Design proposals from the Supplier ecosystem as it also helps them in their design & design optimisation process. However, the aspects of IP ownership, capital requirement for the Research / Development activities, support on bandwidth & select capabilities, and the most important of all – commercialising the IP and ensuring commercial viability are still fluidic and depend on the strength of the OEM-Supplier relationships. There is merit in the OEMs and Suppliers coming together and through some case studies, demonstrate the mutual commitments to pave the way for many other OEMs and Suppliers embracing this and embarking on this bandwagon of collaborative working.

On the materials front, while Plastics & Composites do pose a threat to Aluminium on the light-weighting front, unavailability of the ecosystem in India for advanced material grades and alloys is also a concern. With technologies like 3D Printing and emergence of nano-materials, even the conventional methods of material analysis need to be revisited. FEA should be substantiated with Molecular level analysis, and new manufacturing

processes / technologies may take the forefront to process metal powders and nano-materials.
Amidst all, the silver lining for the Die Casting Industry is a thick long one. While the Mobility transition introduces a wide gamut of opportunities, the applications beyond mobility are is a world of its own to be explored. The icing on the cake is the additional opportunities coming India's way due to Supply Chain re-shoring initiatives by multiple Corporates and Countries. The future is really bright for the Industry and the name of the game is "Collaborate and Co-Create to unlock Sustained Value for the Ecosystem".

Moderator
Uday Sankar Yerramillin
Co-Founder & Director,
USPI CONSULTING PVT. LTD.

Panel Discussion 4
SKILL DEVELOPMENT

At the GDCTech national conference on Smart Factory for sustainable growth held at The pride Hotel , pune on 19th & 20th September, panel discussion was conducted on interesting topic " Skill Development" in Die casting industry as die casting industry is facing pressing problem of talent shortage.

Mr. Sunil Patil, Head learning & Organization Development, Sigma Electric Manufacturing corporation Pvt Ltd moderated the panel discussion and panel comprises of Mr. Manoj Khaladkar, Dean Placements , Army Institute of Technology, Dr Shravan Kadvekar, Director Symbiosis , Centre for corporate and professional learning, Dr. Kamlesh Kumar Singh , Director National Institute of Advanced Manufacturing and Mr. A. H. Patil, Partner MAP alloys.
The panel was very eminent and learned and having representation from industry & academics.
Prof. Manoj Khaladkar delivered very insightful keynote address on the topic of skill development. He highlighted that manufacturing industry should focus on building skills of operators.
Panel deliberated on various problems on skill development & It's solution.
We say that we produce staggering 1.5 million engineering graduates annually, yet very small percentage secure employment. Employability among engineering graduates/Diploma holders is less. As per the team lease, very few are expected to secure the employment this year. Other hand, Industry is not getting right talent especially in manufacturing. Specifically, In the Die casting, our recruiting team face very hard time in getting right talent. It is dichotomy that we have so many engineers who are not getting the Job and Industry is saying that they are not getting right people. Panel discussed the why this is happening.

Panel deliberated on how to bridge skill gap in engineers. Further panel discussed on importance reskilling, upskilling, cross skilling. Industry representative Mr Patil was of opinion that many times die casting industry struggle to meet targets and maintain quality due lack of skilled manpower. He further suggested means to curb this challenge.
Panel was opinion that Die casting industry must become lucrative to aspirant engineers.
Panel further deliberated that in the midst of 4th Industry revolution , it is being said that artificial intelligence , robotics & automation will eliminate many jobs. In this scenario, how the skill sets of the existing manpower should be changed is discussed in the panel discussion. Panel outlined the ways how die industry and academia can come together to address the pressing problem of skill manpower shortages.

Mr Sunil Patil finally presented the case study on skill development in which he presented what Sigma is doing the skill and knowledge building of its employees in everchanging technology landscape. Among the other skill development initiatives of Sigma, the most unique in the context of skill development in the context of die casting domain, Sigma's partnership with local engineering college for skill-based Bachler of vocation (B. Voc) in foundry technology to enhance the skills of sigma's employees in the casting domain. The syllabus of the course is prepared taking in account needs of Sigma.

The panel discussion content is much appreciated by the participants of the conference. This discussion will go long way in giving impetus to the skill development in the die casting domain. All the panelists were duly felicitated by the GDCTECH conference organizer.

Moderator
Sunil Patil
AGM - HR & Training,
SIGMA ELECTRIC MANUFACTURING CORPORATION PVT. LTD.

Panel Discussion 5
DIGITALIZATION & AI

A panel discussion on digitalization and AI covered several key themes:

Impact on Industries: Panelists discuss how digitalization and AI transform the foundry and manufacturing industry. They highlight examples of improved efficiency, process, and data management.

Challenges and Risks: The conversation addressed challenges, including data availability, cost, skilled workforce board approvals, etc.

Future Trends: The experts underscored the increasing importance of digital skills in the workforce. They gave insights into emerging trends, such as the rise of generative AI and the integration of AI with IoT.

Strategies for Adoption: Panelists discussed Best practices for organizations looking to adopt digital tools and AI are discussed, including the need for a clear strategy, employee training, and fostering a culture of innovation.
Overall, the panel emphasized that while digitalization and AI present vast opportunities, they also require careful consideration and proactive management to maximize benefits and minimize risks.

Moderator
Dr. Satish Patil
Founder & CEO, Crysagi Systems

EXHIBITION

Anand Joshi
Chairman Exhibition Committee

No. of Exhibitors 15

No. of Visitors about 160 Nos.
(Including Delegates, Authors, Panellists, Outside Visitors)

Though the number of visitors was limited, the exhibitors were generally satisfied as the visitors were quite knowledgeable and from related fields.

EXHIBITION GLIMPSES

Inauguration of the Exhibition

QUIZ COMPETITION

We conducted the primary rounds of the competition at five zones; Pune, Ahmedabad, Delhi, Chennai and Coimbatore. Final round of the Quiz Competition was held on Thursday 19 September 2024 at Pride Hotel, Pune. This was sponsored by Sigma Electric Manufacturing Corporation Pvt Ltd .

Winners from four zones contested with a great tussle that can be seen by the marks they have obtained.

1. Maxop Engineering Co. Pvt. Ltd. Gurgaon (115 marks)
2. Skyfast. Coimbatore (55 marks)
3. Steel Strips Wheels Ltd. Mehsana (116 marks)
4. Tata Motors Ltd. Pune (115 marks)

The audience enjoyed and appreciated the efforts taken by the teams.

A team from M/s. Steel Strips Wheels Ltd. Mehsana won the contest.

The winning team was felicitated by Mr. Manoj Singh (Deputy General Manager - Advanced Technology Centre SIGMA ELECTRIC MANUFACTURING CORPORATION PVT. LTD.)

Mr. Pramod Gajare
Chairman - Quiz Competition

BEST CASTING COMPETITION

This year was the successive 10th year for this competition; barring the pandemic year.We started this activity in 2014.Pan-India level Best Casting Competition was held on Thursday 19 September 2024 at Pride Hotel, Pune. It was sponsored by Sipra Engineers Pvt Ltd..

This year a dozenful of companies showed their willingness to participate, eleven had registered and ten of them participated.

We brought one change this year that is helping the participants to present their credentials in a better way. From the committee Mr. Amit Tingare took efforts to check all the registration forms, selecting improvement points and discussing the same with the technical representatives of respective companies. Almost all companies responded positively. The committee acknowledges the precious work of Mr. Tingare.

Four experts from industry were on the judges panel.
Mr. A H Patil - MAP Alloys
Mr. Bharataj Patil - Godrej & Boyce Mfg. Co. Ltd.
Mr. Deepak Nerkar - Tata Motors
Mr. Rajesh Sampat - Inspiron Engineering Pvt Ltd.
Our special thanks to the judges for carrying out the assessment process.
The judges appreciated the special efforts taken by the companies while developing the castings. The summary is as follows.

- MSME industries developing critical castings for export.
- For a big complex casting, changing the process from Sand casting to Gravity die casting.
- Successful development of this wall casting with close geometrical and linear tolerances.
- Achieving more than 65% yield in gravity die casting.
- Leak proof casting with much more wall thickness variation.
- Use of latest technologies.
- Excellent problem solving analysis.

The winners are as follows.
Gravity Die Casting -
Pooja Castings Pvt. Ltd. Pune.
High Pressure Die Casting -
Uno Minda Ltd. Hosur.
The winners were felicitated by Mr. M. M. Umadi.(Managing Director SIPRA ENGINEERS PVT LTD.)
On behalf of the committee, I thank the staff of Arkey Conference cell for the timely and consistent support.

Mr. Pramod Gajare
Chairman - Best Casting Competition

BEST DESIGN COMPETITION

PARTICIPANTS

AAKAR FOUNDRY PVT. LTD.
CAPARO ENGINEERING INDIA LTD.
DIETECH INDIA (P) LTD.
GODREJ & BOYCE MFG. CO. LTD.
UNO MINDA LTD.
KSHITIJ TOOLING

WINNERS
HPDC = AAKAR FOUNDRY Pvt. Ltd AND DIETECH INDIA (P) LTD.
GDC = CAPARO ENGINEERING INDIA LTD
LPDC = AAKAR FOUNDRY PVT. LTD.

Mr. Rajesh R Aggarwal
Chairman - Best Design Competition

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WINNERS

CERAFLUX INDIA PVT LTD.

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PARTICIPANTS

- ALLIED REFRACTORY PRODUCTS INDIA PVT. LTD.
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"Amazing response to 82ND coffee talk" 24th August 2024

SPEAKER:
Shri. Yashwant Mahakal,
ASQ Certified Six Sigma expert

TOPIC:
Six Sigma Awareness

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This Month, GDCTECH forum was fortunate to have Shri. Yashwant Mahakal on its Coffee-TALK event.
Yashwant ji talked extensively about fear of using statistics and mathematics in industry on daily basis. He drew the audience through a deep throat process right from "why we are doing business", to "are we satisfied in doing business" and "how we measure the business performance". He simplified the understanding of six sigma through different case studies technical as well as non technical. Every technical problem can be converted into mathematical equation, solve the question, convert the solution back into technical terms, and implement. That simple.Though simple, it requires diligent efforts in getting reliable data.
Audience was delighted hearing & interacting with Yashwant ji. Many interesting questions came up during the QA session.
The coffee-TALK was attended by around 30 people.
GDC-TECH extends its high appreciation and many thanks to Shri. Yashwant ji Mahakal, and to all the attendees. The next talk will in held on Saturday 26th of October.

INHOUSE TRAINING PROGRAMME

Inhouse Training Programme conducted at Rico Auto Industries Ltd., Gurgaon on 21 September 2024 on Melting & Metal Treatment and Metallurgy of Aluminium Cast Alloys
Faculty was Prof. (Dr.) Ashok Sharma, Charted Engineer & Consultant.

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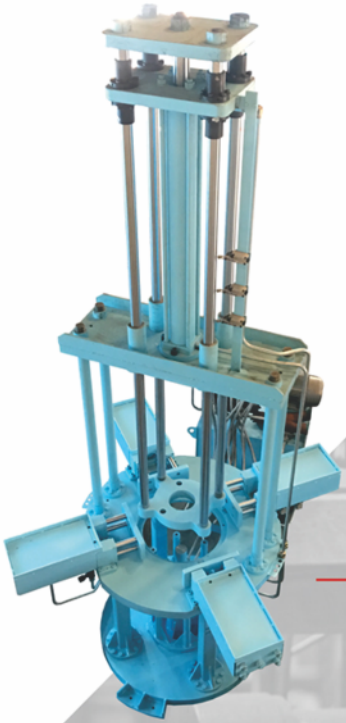

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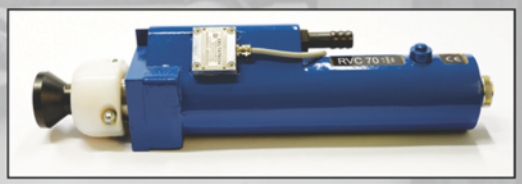

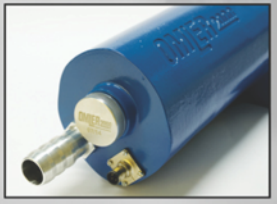

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