Dedicated to Diecasting Industry

ALUCAST®

PARTNER IN PROGRESS FOR ALUMINIUM AND DIE CASTING INDUSTRY

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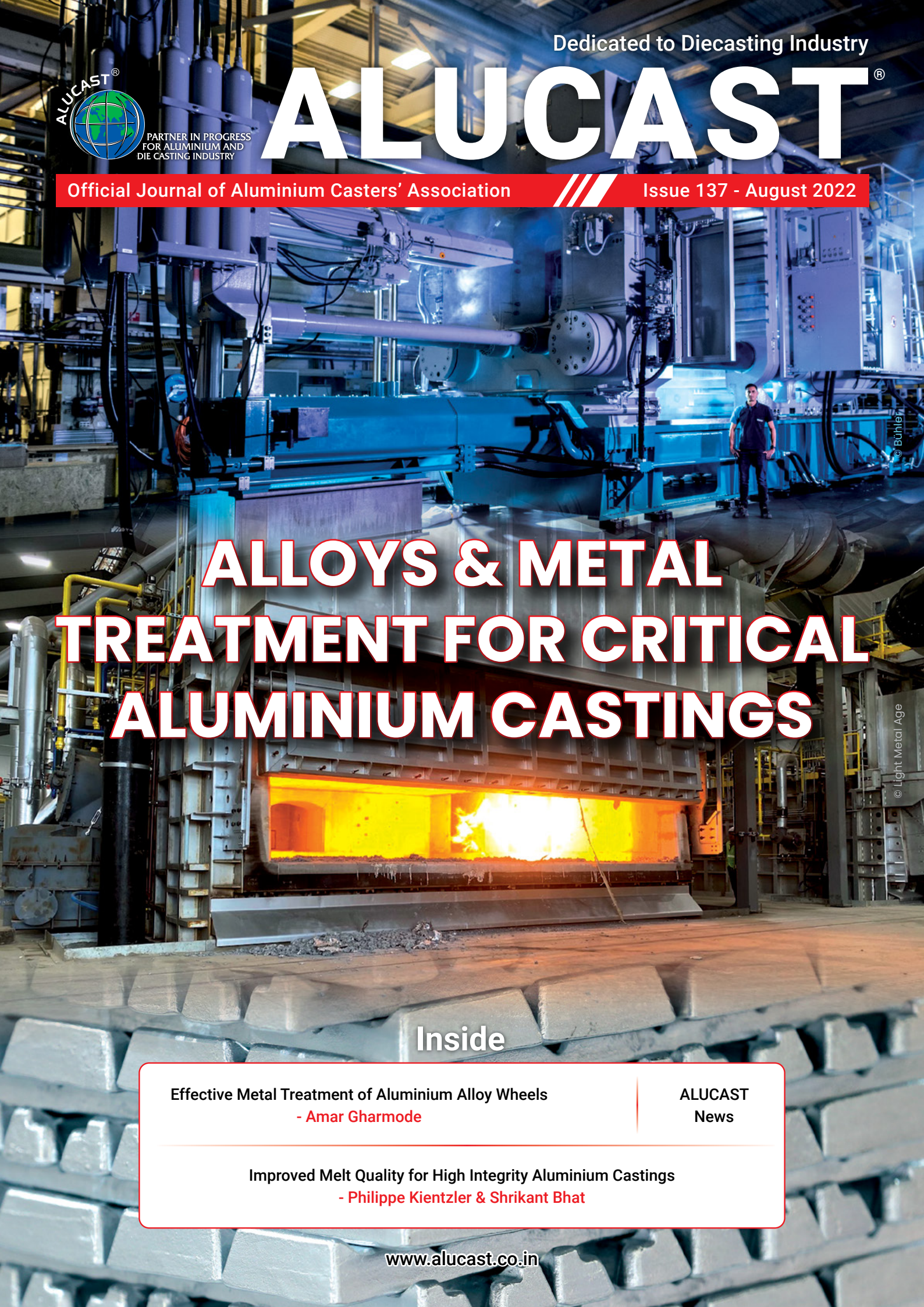

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ALLOYS & METAL TREATMENT FOR CRITICAL ALUMINIUM CASTINGS

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TOTAL	**60**	**136**	**54**	**250**

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ALUCAST®

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N. Ganeshan Editor

Dear Readers,

Inflation has become a global phenomenon at present. Even the rich and developed nations are facing abnormally high level of price rise in many commodities including petrol, oil & gas. Agencies worldwide have projected a slowing of global economic growth, which is expected to witness headwinds with rising commodity prices, supply chain bottlenecks and faster than the projected withdrawal of post pandemic monetary accommodation provided by various governments. Indian economy is also expected to witness slowdown in growth, though will be much better than the other developing & emerging market economies. As per a world bank report published in a recent issue of Global Economic prospects, Indian economic growth is forecast to slow down to 7.5% in this fiscal year 2022/23, with resistance from rising inflation, global supply chain disruptions, and geopolitical tensions offsetting buoyancy in the recovery of services and consumption from the pandemic. This is the second time that the World Bank has revised its GDP growth forecast for India in the current year and has trimmed the forecast from 8.7% to 8% and now it is projected at 7.5%. India's economic growth, the World Bank said, will be supported by fixed investment undertaken by the private sector and by the Central Government, which has introduced several incentives and reforms to improve the overall industrial & business climate.

Annual wholesale price inflation, climbed to 15% plus, in first quarter of this fiscal year, remaining in double-digits for the 15th month in a row and highest in the last 15 years. High inflation prompted the central bank to hold an unscheduled meeting to raise the benchmark interest rate by 40 basis points to 4.40% in May and another hike is followed immediately after, to tame the rising prices. India's wholesale prices accelerated at the fastest pace in least 17 years as the ongoing Ukraine crisis and a weak rupee pushed up import dependent energy and raw material costs and thus raising risks for businesses that are unable to pass on costs. To control spiralling retail prices, India had recently cut excise duty on petrol and diesel and also waived import duty on some raw materials used in the steel and plastic industry. Besides, export duty was hiked on iron ore and iron pellets.

Recent 50 basis point repo rate hike by the Reserve Bank of India (RBI) taking the repo rate to 4.9% and counteractive policy action by Government in form of excise duty cuts, rationalisation of custom duties, enhanced subsidy to targeted sections, trade policy changes and government's continued commitment to enhance capex are expected to restrain inflation while sustaining economic growth in the ongoing fiscal year. In the medium term, the successful launch of the Production Linked Incentive Scheme, development of renewable sources of energy while diversifying import dependence on crude oil and strengthening of financial sector are expected to drive economic growth. The high-wire balancing act between maintaining growth momentum, restraining inflation, keeping the fiscal deficit within set budget limits and ensuring a gradual evolution of the exchange rate in line with underlying external fundamentals of the economy is the challenge for policymaking in this financial year.

Fuel consumption in India, in the month of June, rose by 17.9% from a year earlier, as per government data, as demand in the world's No.3 oil consumer headed back towards pre-pandemic levels. Global oil prices have surged in response to concerns about tight supplies and disruption linked to oil & gasproducer Russia's invasion of Ukraine. But Indian consumers have been protected to some extent as most Indian refiners have bought cheaper Russian fuel that the West has spurned. India quietly becomes an exception, in more or less keeping fuel prices intact, largely thanks to its widespread buying of heavily discounted Russian crude. Some Indian refineries made windfall profits by exporting some refined products to gain from higher overseas margin. However, the government, in the last week to try to increase local supply, imposed a windfall tax on producers. Further, it is widely observed that the purchasing power of India's middle class is rising in spite of recent spike in food and energy prices, which pushed up the consumption of petrol and diesel.

It appears that the unemployment rate has declined to levels seen prior to Covid-19, but the labour force participation rate remains below pre-pandemic levels and many of the workers have shifted to lower-paying jobs. In India, the focus of central government spending has shifted toward infrastructure investment and at the same time labour regulations are being simplified, underperforming state-owned assets are being privatised and the logistics sector is expected to be modernized and integrated. In the long terms, all these measures undertaken by both central & state governments bound to give better results.

***

Effective Metal Treatment of Aluminium Alloy Wheels

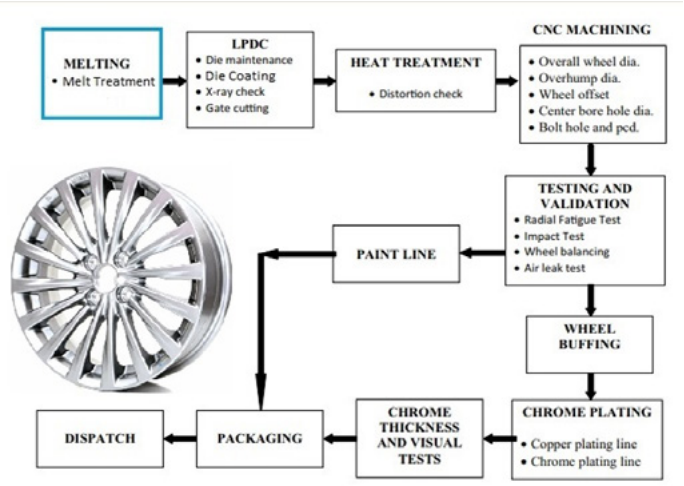
- Amar Gharmode, GM Technical, Ceraflux India Pvt. Ltd.

Aluminium is a chemical element in the Boron group with symbol Al and atomic number 13. It is a silvery-white, soft, nonmagnetic, ductile metal. It can't be used as it is for commercial usage, require alloying with other alloying element. Aluminium is very reactive; in molten stage immediately react with atmospheric moisture and forms Al2O3 and H2. Hydrogen gas remains in molten metal and during solidification try to expel out, thus raise to micro porosity, sometimes blow holes. Inclusion of oxides leads to failure of finish product. To achieve Mechanical properties like Tensile strength, Elongation, Hardness and desire microstructure etc, metallurgical treatment is a must.

Alloy wheels constitute a very prominent aspect of an automobile. This is because it forms an integral part of overall aesthetic look of the automobile. The A356 Aluminium alloy with 7% silicon as its prime alloying element forms the popular material for the manufacture of automotive alloy wheel castings.

The wheel of a motor car is an important component which has to fulfil a variety of technical requirements such as strength, elongation, pressure tightness etc. Aluminium wheels improve driving comfort by reducing the un-sprung mass and also lower brake disc temperatures, due to better heat conductivity. During wheel design aluminium casting processes give the greatest freedom. Low pressure die casting has become the most commonly used casting process for producing aluminium wheels in economic large scale production. Even though higher initial material cost as compared to steel can be compensated by the higher recycle value of aluminium. The main advantages by the use of aluminium in automobiles are the gasoline savings by light weighting and the excellent recycling properties of aluminium.

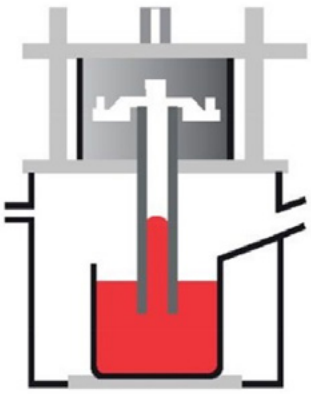
Flow Chart Of Aluminium Alloy Wheel Production:



MELTING:

The normal Charge Ratio: 70:30 (Primary ingots: Rejected Wheel / molten metal from chips) is used for wheel production. The Primary Ingots are the charge material in the form of ingots having composition AlSi7Mg0.3 and Fe should be 0.15% Max. The molten metal produced from melting of machined chips and scrap in scrap melting furnace.

LPDC CASTING:



Ceral Stalk Tube

Ceramic Sleeve inside CI Stalk tube

In low pressure die casting, the die is filled with metal from a pressurised furnace, with pressures typically around 0.7 -

2.0 bars. The holding furnace is positioned in the lower part of the vertical die casting machine, with the molten metal injected upwards directly into the bottom of the mould. The pressure holds the metal in the die until it solidifies. One of the main advantages of this process is the precise control of die cavity filling.

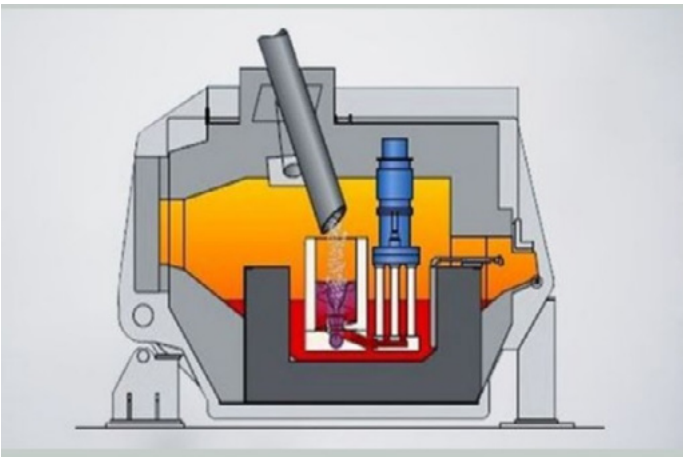
Molten metal flows quickly and smoothly through the feeding conduits **(CERAL STALKTUBE)**, reducing oxide formation and preventing porosity.

STALK TUBES are made from Ceramic and Cast iron materials.

Ceramic Material includes Aluminium Titanate (AlTi), Silicon Nitride (SiN),Dense Fused Silica. **Ceramics are chosen for their insulation and long service life. These are highly expensive.**

Cast iron Stalk tubes are less expensive with high mechanical strength, can be designed as per customer specifications. Inside the stalk tubes Ceramic sleeves are fitted and outside fixed with special lining material to avoid the iron pickup from cast iron stalk tube

In Chip melting process, to avoid metal burning during melting special type of melting process adopted.



"Ceral Rotor Shaft"

Special circulation system adopted using Rotor Shaft, which creates vortex where chips are submerged in molten metal to prevent oxidation and increase usable yield.

MELT TREATMENT:

This includes
1. Cleaning and Drossing-off.
2. Degassing.
3. Modification.
4. Grain Refining.

1. CLEANING & DROSSING FLUX:

Fluxes are inorganic compounds. They can be added manually or can be automatically injected.

Cleaning & drossing-off fluxes agglomerate the oxides and inclusions, allowing easy removal from the surface of the melt. Exothermic reaction of flux ensures that liquid aluminium trapped in the dross layer is returned to the melt. Fluoride compounds- contribute to metal separation owing to their high wetting capacity. When the melt is ready for drossing-off, the flux is spread over the molten metal surface, allowed to stand for a few minutes and then rabbled into the dross for several minutes with a skimmer. For best results the melt should preferably in the range 720-760°C. Holding of flux at molten metal temp. helps to activate the flux, heating the dross and giving good metal separation. The dross is then pulled to the door, allowed to drain and transferred to a dross bogie. If the dross in the bogie is raked, further metal will collect in the bottom. Untreated dross may contain 60 to 85% Aluminium metal. However with effective drossing flux treatment the aluminium content of dross can be reduced to 25-40%.

Flux:

Granular Flux

GRANULAR FLUX: "CERAFLUX GR-510W"

Grain Size: 1-6 mm

Uniformity in Chemical composition, each grain represents chemistry of entire flux.

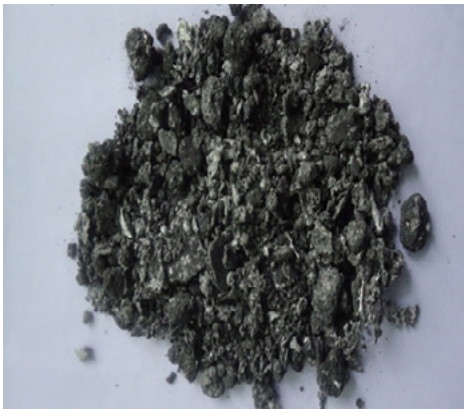
By using fluxes in granular form rather than as conventional powders, the effectiveness of the flux can be greatly

increased, the handling improved and the undesirable, hazardous emissions can be significantly reduced. The higher cost of granulated fluxes (arising from the additional manufacturing process involved) is compensated by the much reduced quantities needed.

Advantage of Granular Flux over Powder Flux:

1. The dose is 0.05-0.15% of Metal charge.
2. Very low level Smoke emissions during use. Tests have shown smoke reduction of more than 85%.
3. Excess burning of metal during drossing avoided.
4. Attack on furnace refractory is much less.
5. Working condition is better.
6. Dross formation is in powder form.

Treated Dross

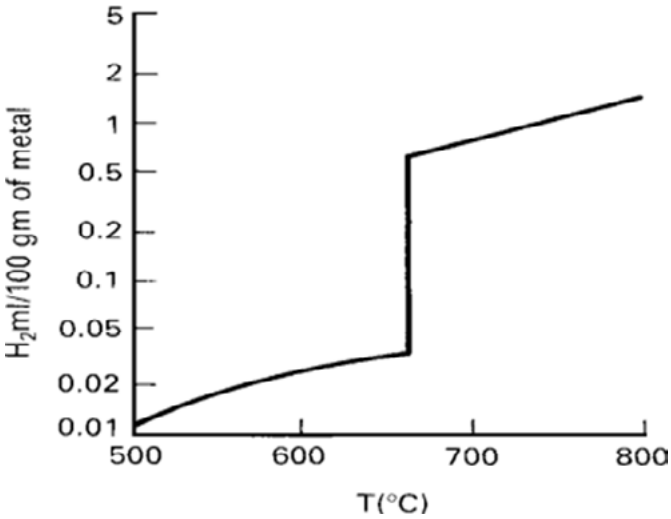


Untreated Dross

Metal Charge : 500 kg
CERAFLUX GR-510W =340 gms
% Addition of Melt = 0.068%
Dross Weight = 3.04 kg
% Dross Formation = 0.608%

Trials conducted at our overseas customer

2. DEGASSING OF AL ALLOYS:

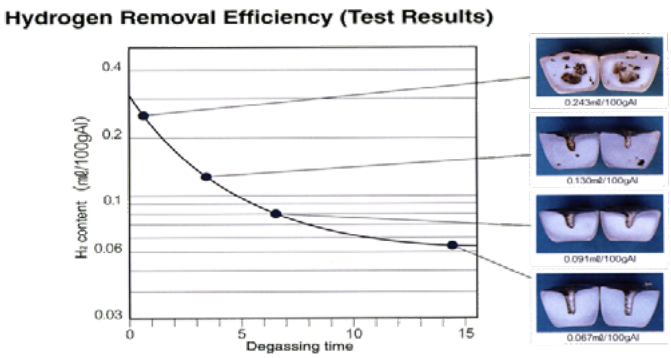


$2Al + 3H_2O \rightarrow Al_2O_3 + 3H_2$

H_2O (Moisture from Atmosphere)

Hydrogen(H_2) has a high solubility in molten Al which increase with melt temperature but the solubility in solid Al is very low. As the alloy freezes, H2 gas is expelled forming gas pores in the casting. The maximum conc. of dissolved hydrogen possible in Al Alloys can be as high as 0.8ml H2/100gm. By careful attention to melting practices this can be reduced but with the best practice, remelted foundry alloys may be expected to contain 0.06-0.1ml H_2/100gm Al.

Degassing of aluminium is done by:
MDU / Rotary Degassing- Dry Nitrogen / Argon gas is purged in to molten metal using rotary degassing system which produce well dispersed small bubbles. These bubbles will ensure effective removal of hydrogen gas.



3. MODIFICATION OF ALLOY:

Changing the morphology of Silicon from Needles to rounded shape is called "modification". This phenomenon is concern only with Eutectic Si structure of Al-Si alloys (Si up to 12%).

Benefits with modification:
The remarkable improvement in the mechanical properties of the castings.

If not modified?

Silicon will form needles which will acts as notches or internal stress points with damaging results on tensile properties.

What are the modifiers?

These are the AlSr-10% Master alloy.

Application Temp.: 740-750°c for effective result.

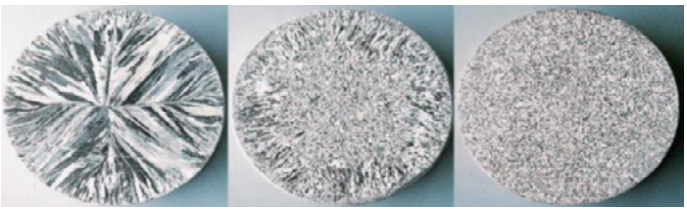
Addition rate : 0.1-0.2% for 10% Strontium Master alloy.

Size available : 200 gms Cast Rod/Waffle,9.5 mm dia Rod.

4. GRAIN REFINING OF ALUMINIUM ALLOYS

A fine uniform grain structure is desired in Aluminium castings. The type and size of grains formed are determined by alloy composition, solidification rate and the addition of master alloys (grain refiners) containing inter metallic phase particles, which provide sites for heterogeneous grain nucleation.

Addition of certain elements to Aluminium alloys melts can provide nuclei for grain growth. Titanium, particularly in association with boron, has a powerful nucleating effect and is the most commonly used grain refiner.



Effects of grain refinement:

Increased tear resistance.

Increased pressure tightness.

Improved response to thermal treatment.

Improved appearance after surface treatments, such as anodising, electrochemical and mechanical finishing.

Improved feeding characteristics.

Grain Refiner is supplied in following form.

1) MASTER ALLOY : CERALOY TiB 5:1

2) GRANULAR FORM : CERAFLUX GR-2815

ALUMINIUM MASTER ALLOY : CERALOY TiB 5:1

CUT ROD: 9.5mm rod cut in to 50 cm (100gms) or 100 cm (200gms) pieces.

9.5 dia. Cut Rod 100/200 gms

200 gms Cast bar

200 gms waffle

Ideally suited for foundries to make accurate grain refiner addition to ladle. Combining easy handling with superior metallurgical products.

Exact additions are made by simply stirring the required nos. of rods in to the melt.

For Furnace additions Cast bar or Waffle ingot is added as the melt treatment is completed, usually within 20 minutes prior to casting ensuring reliable grain refinement of ingots.

GRANULAR FLUX: CERAFLUX GR-2815

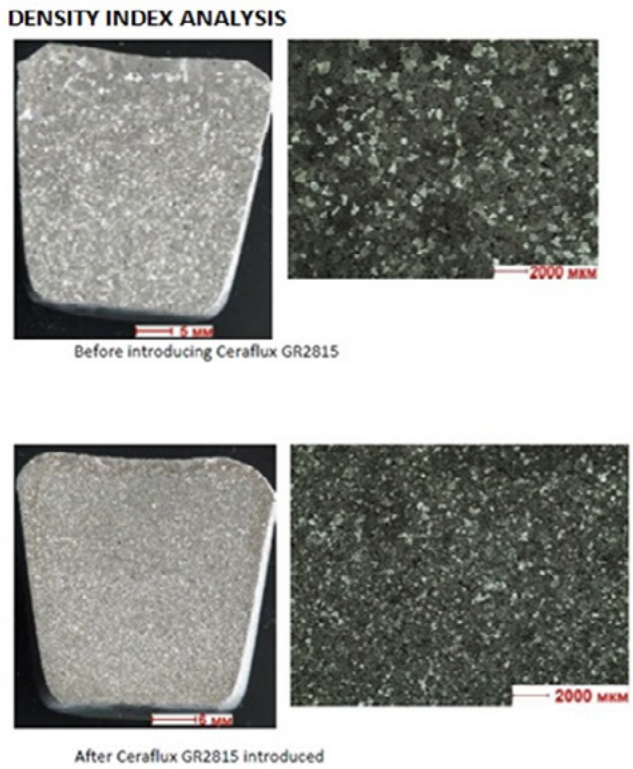
Grain Size :1-6MM

Application Rate : 0.1% of Metal Charge

Application Temp. : 740-750°C

Flux is added to furnace and mixed with rotary degassing system. After completion of treatment dross is removed and metal taken for casting.

Modified with GR2815
Pic. Wheels appearance KL-269 Batch#681



Macrostructure of Density Index Samples

DIE COATING:

Function of DYCOTE:

The principal functions required of a coating for die casting are:

1. Control of the metal flow to ensure that it reaches all parts of the die at a sufficient temperature to prevent the formation of seams, cold laps, etc.
2. Control of heat transfer to obtain better solidification and ensure that the castings are properly feed.
3. Easy release: since castings are extracted at just below the solidification temperature, easy release ensures that castings do not come out deformed.
4. Good surfaces, and therefore a reduction in finishing costs.
5. Longer die life, therefore increased productivity and reduced maintenance. These results are directly in line with the characteristics of DYCOTE.

DIEDRESS-1400:

Boron Nitride based coating- Applied on Top and Side Mould

DIEDRESS-3900:

Titanium dioxide based coating- Applied on bottom Mould.

Dilution Ratio : 1: 3-4 Product :Water
Die Temp. : 250-300°C
Application : Spray

CONCLUSION:

Metallurgical products / master alloys and diecoates used in melt treatment of Aluminium alloy wheels plays very vital role by,

1. Achieving desirable microstructure.
2. Achieving desirable mechanical properties such as tensile strength, elongation, hardness etc.
3. Aesthetic look.

***

Author

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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

Introduction

Metal treatment is a critical part of the foundry process, which often has a significant impact on casting [1] quality [2], reject rates and costs. Existing practice often consists of hand fluxing or rotary degassing flux injection, but both have important restrictions or limitations.

Hand fluxing can be unreliable since it is operator dependant. Variations in addition rates, treatment times can cause major differences in efficiency and melt quality when cleaning, grain refining or doing sodium modification. This is especially true in High Pressure Die casting (HPDC) where the number of ladles or furnaces treated can exceed 100 per day.

Rotary degassing flux injection has resolved some of these issues by reducing the variability due to the human operator. It also has increased treatment consistency when performing a larger number of treatments per day. Unfortunately, the injection of flux through a rotating shaft requires a specially formulated and graded flux to prevent blockages. Fine particles smaller than 1 mm can become mushy during injection, whereas those larger than 2 mm can bridge inside the spinning shaft, which in both cases causes the treatment to breakdown. This blockage issue will limit the injection rate of the flux and hence can sometimes increase treatment time.

Furthermore, the application of rotary flux injection is often limited to cleaning fluxes as most other fluxes like sodium (Na) modifiers, Ti-B grain refiners or trace element removal fluxes are more difficult to inject and often lead to shaft blockage which is causing troubles for the users. As a response to these issues above, Foseco developed the MTS 1500 [3], a robust blockage- free and reliable system to achieve multiple functions in a foundry like:

• Faster degassing using more efficient XSR / FDR rotor design
• Cheaper cleaning & drossing especially in high-pressure die-casting
• Constant and repeatable sodium modification
• Cost efficient Ti-B grain refinement in gravity and wheels
• Cost saving for drossing in Aluminium HPDC
• Oxide removal in Al HPDC, pistons, wheels and chip melting using VMET assessment.

MTS 1500 principles and technology

MTS 1500 (see Fig.1) is an automated Metal Treatment Station based on Foseco's proven FDU Rotary Degassing technology that was sold to more than 2000 units worldwide.

MTS 1500 [3] is an automated system that can perform most metal treatments.

It is a controlled and automatic addition of fluxes that (see Fig.2):
• Performs all metal treatment operations and requirements in a single process.
• Increases productivity & reduces costs
• Eliminates operator involvement
• Reduces risks and emissions
• Improves efficiency of the treatment
• Is blockage free unlike some rotary flux injectors
• can add all grades of fluxes

Figure 1

MTS 1500 allows for the successive or simultaneous addition of a range of newly and proprietary developed COVERAL MTS fluxes.

These granulated fluxes are typically ranging between 0 – 5mm in size.

But the equipment can be adapted to accommodate larger particles as well as metal treatment products other than fluxes.

Typical addition rates are 20g/s and as high as 1,2 Kg / min.

Upon request the MTS 1500 can be customised to an addition rate of 40g/s which amounts to 2,4 Kg /min.

Figure 2

The MTS 1500 technology comprises 3 major components:

1. The Foundry Degassing Unit (FDU): see Fig.3

Our rotary degassing unit is the basis of the system as it provides a stable platform to which all other components can be attached. Any design of FDU unit can be used to build an MTS 1500.

The primary purpose of the degassing unit is to introduce a rotating shaft into the melt through which Nitrogen or Argon gas is injected.

This produces a fine dispersion of gas bubbles inside the melt, which removes hydrogen as well as oxides and makes for better castings without porosities and inclusions.

Furthermore, degassing is always a part of melt treatment and can eliminate excess moisture that fluxes might have introduced.

The MTS 1500 can have up to 2 hoppers to add 2 different fluxes.

Each hopper has a 20 Kg capacity. The hoppers are designed to protect fluxes from the environment and to prevent moisture pick-up.

The screw-dispensing unit is mounted at the hopper outlet and is capable of dispensing accurate and consistent amounts of flux (+/- 3%) into the vortex. Adjusting the length of time the screw operates can control the required flux amount.

The end of the dispensing tube is positioned next to the spinning shaft and directly above the vortex to ensure that all the flux will be added to the metal.

2. The movable baffle: see Fig.4

The baffle plate can be moved up and down depending on the cycle phase.

The absence of the baffle helps create the vortex that is needed to efficiently mix the fluxes inside the melt. The presence of the baffle in the melt eliminates the vortex and creates optimum conditions necessary for cleaning and degassing.

The baffle plate is made of INSURAL, an insulating material non-wetted by molten aluminium. It is durable and resistant to thermal shock.

Figure 3

Figure 4

3. The Foseco patented pumping XSR and FDR Rotors:

Foseco developed and patented the XSR (see Fig.5) and FDR rotors (see Fig.6) designed to efficiently mix the flux into the Aluminium melt while remove unwanted gas and inclusions. They are highly efficient pumping rotors, which creates a strong mixing action in the melt.

Thanks to their pumping efficiency, it allows for good reaction between the fluxes and the entire aluminium melt.

Both XSR & FDR Rotors are a key component of the MTS 1500 system and enable:

• Superior degassing efficiency compared to standard designs
• Time savings during treatment and degassing cycles
• High performance at lower RPM, typically 350 – 450 RPM

Figure 5

Figure 6

MTS 1500 Degassing performance

Hydrogen gas porosity is one of the primary concerns of Aluminium foundries. The MTS 1500 when used in conjunction with our patented XSR / FDR Rotors can efficiently remove gas from the melt. Figure 7a and 7b show RPT (reduced pressure test) samples @ 80mb of Al-Si7Mg before and after 4 minutes of degassing with MTS 1500. The measured density before MTS 1500 degassing is 2.34 g/cm3 The measure density after MTS 1500 degassing is 2.68 g/cm3. Average data shows that MTS 1500 is able to degas any foundry alloy within 2-8 minutes at temperatures between 680°C to 780°C.

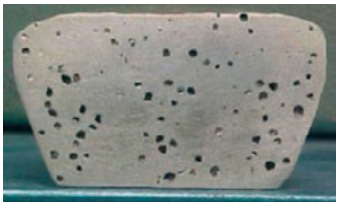


Figure 7a before MTS 1500 degassing

Figure 7b after MTS 1500 degassing

Laboratory scale degassing experiments:

Foseco undertook some comparative degassing measurements (see Fig.8) performed in a 500Kg crucible (BU 500) of AlSi7%Mg alloy using 18l/min of Nitrogen.

A hydrogen measurement device was used to continuously monitor the hydrogen content in the melt.

Within 3 minutes the MTS 1500 + FDR rotor system can reach 0.1 ml/100g of hydrogen thus outperforming standard rotors in this demanding application. This performance is especially valuable in un-heated ladle treatments where a shorter degassing time means less temperature loss and hence energy savings.

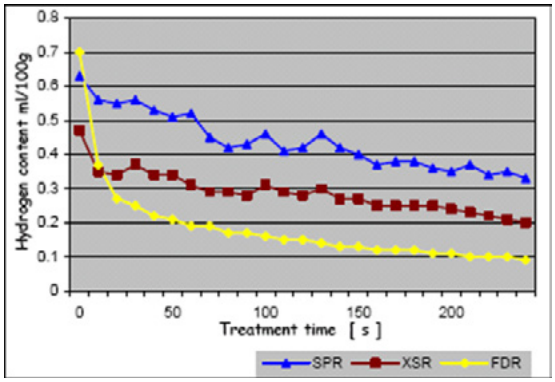


Figure 8

Reliable and consistent Sodium Modification

In the last 10 years, Strontium (Sr) modification has become the most popular modifying agent since it doesn't suffer from the fading issue linked to the use of sodium (Na).

Nonetheless, most people recognise that Sodium is a stronger modifier than Strontium in Aluminium-Silicon alloys. In sand and gravity castings, sodium modification is still used for thicker or difficult castings that are sensitive to shrinkage.

To address this issue, Foseco developed a range of powerful sodium modifiers with a low addition rate (0,1%) that is able to introduce 80 ppm –120 ppm of sodium into Aluminium-Silicon alloys.

Figure 9 presents the benefits of Coveral MTS 1572 in a gravity die foundry making safety critical components for the automotive industry.

The Al-Si12%-Cu-Ni-Mg alloy is held between 740 – 760°C in a 300 Kg (BU 300) gas fired crucible furnace. The former practice consisted of a manual-fluxing treatment followed by a 15- minute degassing cycle.

Unfortunately, this practice is not able to achieve consistent sodium levels after degassing, as there is a +12% variation in sodium content from one treatment to the next.

Using the MTS 1500, the foundry is now able to achieve consistent sodium levels, which result in better consistency of casting properties. Additionally, treatment times and flux addition rates were reduced significantly, which is making an impact on the overall treatment costs.

Gravity Foundry	Degaser + manual flux addition	Automated MTS 1500
Flux used	Proprietary flux	COVERAL MTS 1572
Amount of flux used	890 g + 8%	270 g + 3%
Flux Addition rate	0.3 %	0.1 %
Treatment time	15 minutes	9 minutes
Density achieved after degassing	2.68 g/cm^3	2.69 g/cm^3
Variation in sodium content	+ 12.7%	+ 5%
Sodium (Na) content before treatment	< 18 ppm	< 18 ppm
Average sodium (Na) content after treatment	80 ppm	78 ppm

In order to better understand the savings that MTS 1500 can generate in the case of sodium modification, we undertook some extensive lab testing designed to compare sodium uptake (yield) as a function of flux quantity used both in a manual addition and an MTS 1500.

Results in figure 10 shows that MTS 1500 is 2,5 times more efficient at releasing sodium than the Standard degassing units + manual flux addition.

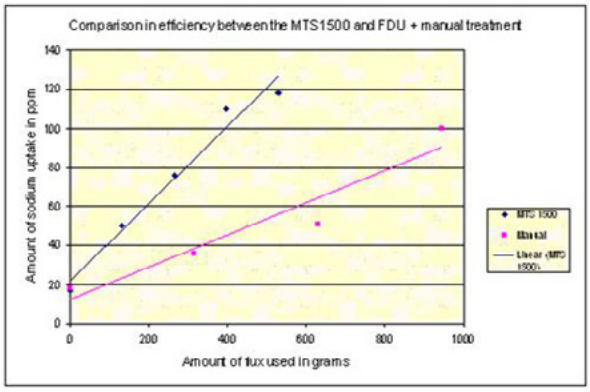


Figure 10

Cost efficient grain refinement in Aluminium Gravity

Aluminium grain refining [4] is one the melt treatment steps that affects most the mechanical properties of castings. It increases elongation [2], resistance to fatigue, improves machinability; reduces hot tear, the size of porosities and the duration of heat treatment. It can also disperse micro-shrinkage in some difficult castings.

Al-Ti5-B master alloys have become the standard practice in foundries around the world, but they are not always the most cost-efficient solution as they contain only 5% Titanium and 1% Boron whereas the remaining 94% Al has no influence on grain refinement.

This Ti-B concentration typically requires a 0,1% addition rate to achieve optimum grain size.

To reduce the addition rate and generate some savings for the foundries, Foseco developed a range of highly concentrated Ti-B grain refining flux [4], which also has an additional cleaning effect on Aluminium melts.

Figure 11a & 11b show the macrographs before and after MTS 1500 treatment of an Al-Si7%- Mg0,3% alloy used to make suspension components for the automotive industry.

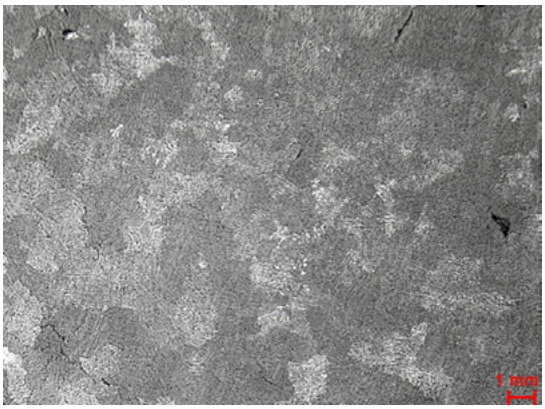


Figure 11a, as melted

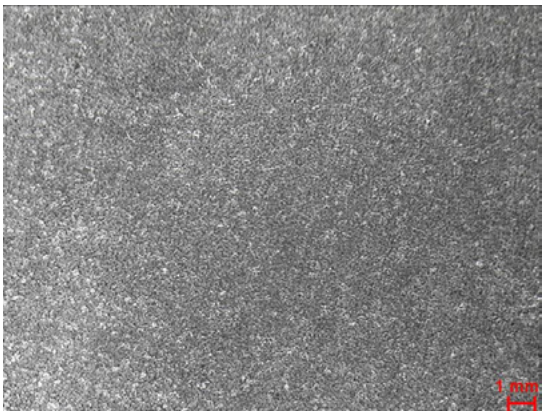


Figure 11b, after Coveral MTS 1584

Using only 0,04% addition rate for Coveral MTS 1584, we can match the grain size obtained with 0,1% AT5B1 addition. This represents a 60% reduction in addition for the same grain refining efficiency.

We did a cost comparison between Ti-B rod and MTS 1584 summarised below.

MTS 1500 can reduce the (grain refining + melt cleaning) cost from 1,60 € down to 0,70 € / Tonne of Aluminium, i.e. a 56% saving for the foundry.

	Addition Rates	Addition rate / 1000 Kg Al	Grain Refining Cost / 1000 Kg Al	Other Savings	Treatment Cost / 1000 Kg Al
Al-Ti5%B1%	0,10 %	1,0 Kg	3,00 €	1,40 € *	1,60 € / Tonne
MTS 1584	0,04 %	0,4 kg	1,20 €	0,50 € **	0,70 € / Tonne

* AT5B1 contains 94% Aluminium which is recovered by the foundry and valued at 1500 €/T

** Coveral MTS 1584 doesn't require any additional cleaning flux, which is a savings of 0,50 €.

Superior grain refining in LPDC wheels using MTS 1582 - Grain refiner

Aluminium wheels are one of the most important automotive castings made mostly using the Low-pressure diecasting process. As OEM wheels are considered safety components, it is critical for these castings:

• To be exempt of gas and shrinkage porosity
• To be free of oxides and inclusions
• To have a very fine microstructure which will ensure adequate mechanical properties

Grain refining [4] is one of the critical steps which most foundries achieve by adding Ti-B rod master alloy. The typical addition rate is usually 0.1%. Fig.12 is showing the key parameters used in an Asian LPDC wheel foundry where A356 alloy is being treated in 700 Kg transfer ladle prior to transfer into the low-pressure furnaces.

Alloy A356.2	Ti-B traditional process	Coveral MTS 1582
Ladle Size	700 Kg	700 Kg
Ti-B Flux Quantity	-	310 g
Master alloy Ti-B rod	500 g	-
Degassing Time	9 min	9 min

Table 12

This wheel foundry was using 500 g of Ti-B rod master alloy in their traditional process in order to achieve the required mechanical properties. The newly introduced MTS 1582 process [4] was able to achieve similar quality levels with only 310 g of flux addition. Fig. 13 compares the degassing efficiency and Titanium levels without & without any Ti-B master alloy addition.

Alloy A356.2	Ti-B traditional process	Coveral MTS 1582	Remarks
RPT Density @80mbar	2.65	2.65	Identical
Chemical Analysis	Ti : 0.114%	Ti : 0.114%	Same level
DAS in spoke section	45.88µm	47.21µm	Spoke Section (Hot Area)
DAS in rim section	26.09µm	27.26µm	Rim Section (Cold Area)

Table 13

Furthermore, in order to compare both grain refining processes, the foundry took samples from several wheels to measure UTS and Elongation. From Table 14, we can see a clear improvement of the mechanical properties despite addition of a smaller amount of MTS 1582 grain refiner.

Properties in Wheel Hub	Ti-B traditional process	Coveral MTS 1582
Yield Strength (N/mm^2)	208.1	213.5
Tensile Strength (N/mm^2)	276.0	286.7
Elongation (%)	6.8	8.0

Table 14

Fig.15 shows some micrography pictures taken from the wheel spoke which was treated with MTS 1582

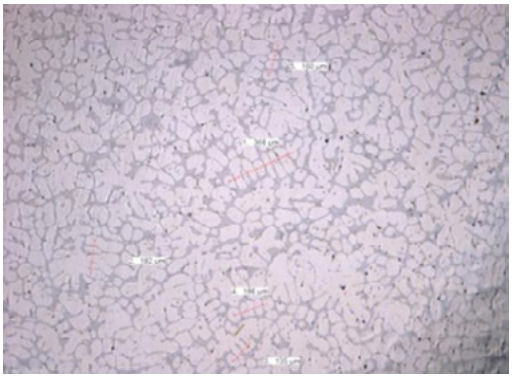


Figure 15

Grain refiner. We can see the structure is very fine and homogeneous. DAS measurements gave a value of 47 µm which is fitting the requirements of modern OEM wheels.

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

Figure 16

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. 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.

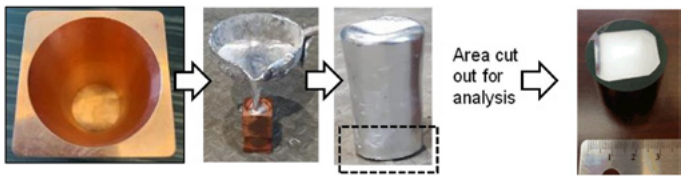


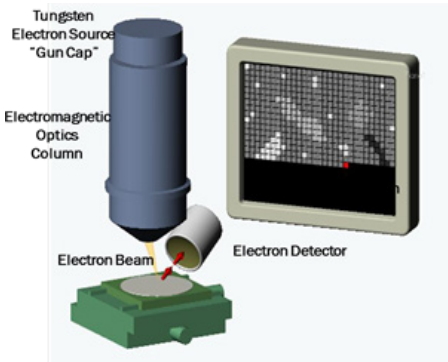
Figure 18

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

Images 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



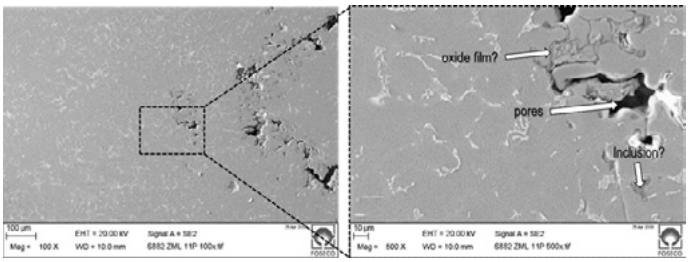


Figure 19

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.

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• 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 (mm²)	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

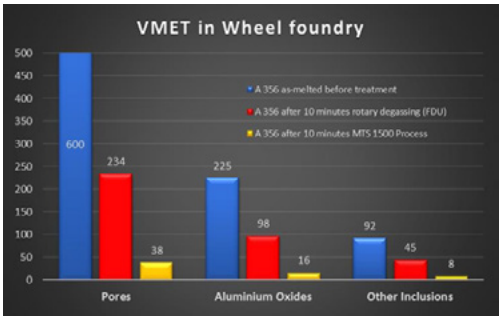
• Total Other inclusions also reduce from 92 to 45 with FDU and to 8 after MTS

• 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:

- Casting: Automotive transmission
- Alloy: ADC12 secondary ingot

Figure 23

- Ladle capacity: 1400 Kg
- Flux addition: 0.03% Coveral MTS 1565
- Treatment time: 3 min only
- Rotor XSR 220.70 + DSK 75/800.70

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.

Table 24

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 ↘↘

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

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

Figure 25

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 + CaCl2 (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 ↘↘**

Table 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.

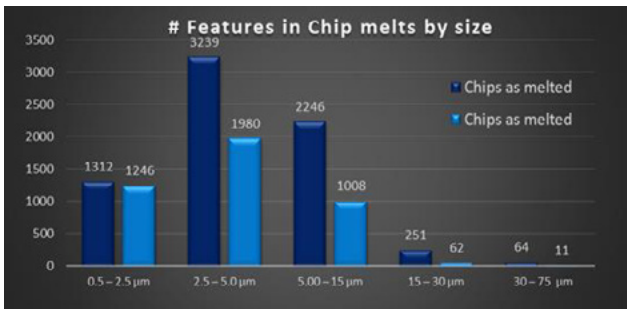


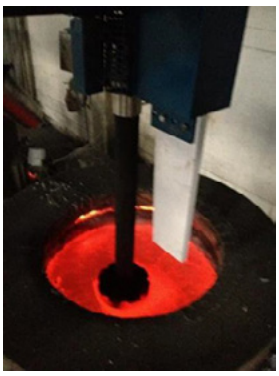
Figure 27

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.

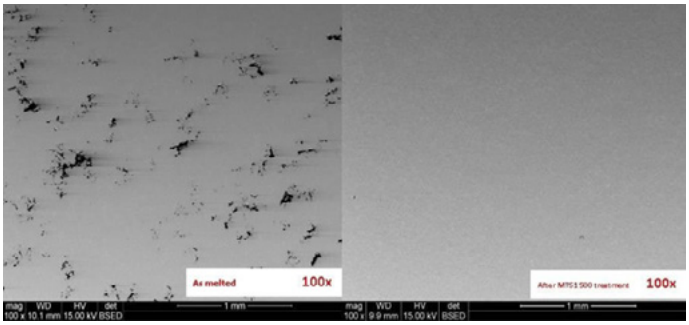


Figure 29

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

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.

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**

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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Author

Dr. Philippe Kientzler, MS in Metallurgy, Mineral Processing & Powder Metallurgy, is associated with the FOSECO, Nonferrous Group for over 16 years with postings at Shanghai, (China), Kobe (Japan), Tamworth (UK), and Lognes (France).

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.

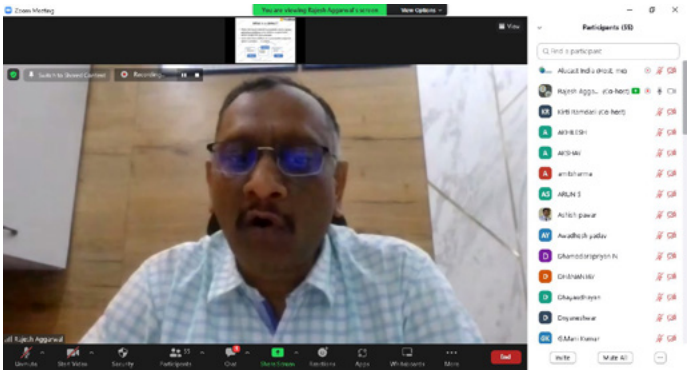
ALUCAST webinar on
'Casting Defect Analysis & Solutions'

Virtual Webinar on the Zoom Online Platform

Wednesday, 29th June 2022 from 03:00 pm To 05:00 pm IST

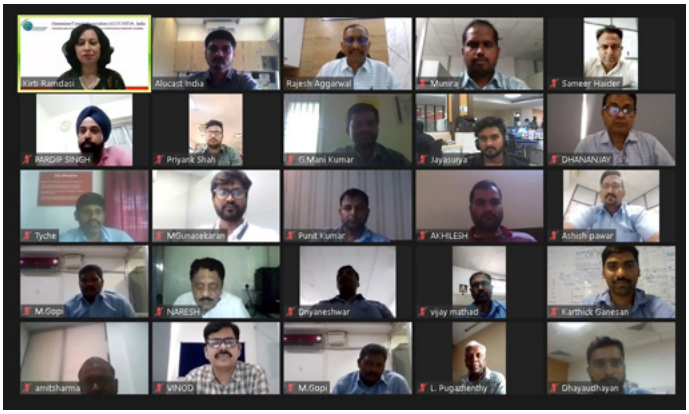
Aluminium Casters' Association (ALUCAST)®, India organized a Webinar on 'Casting Defect Analysis & Solutions' on Wednesday, 29th June 2022 from 03:00 pm to 05:00 pm IST.

The Webinar focused on the following key points:
- Defects classification => Cold defects and Hot defects
- Understanding the root cause of these defects
- Action plan to eliminate the root cause



The Expert Speaker for the Webinar was Mr. Rajesh Aggarwal, Director – TechSense Engineering Services. A Mechanical Engineer with Masters in Industrial Engineering and Management, Mr. Rajesh is a business professional of repute with 31 years of experience in the field of Aluminium Die Casting and the other Engineering Industry - Product and tool design for Aluminium Die Casting components in the Automotive and the Non-automotive Sector. A Mechanical Engineer with Masters in Industrial Engineering and Management. He has worked in different capacities & in higher & responsible positions with PSG Wesco Co. Ltd., Bangkok, Thailand, the Hero Motors, Maharaja Whiteline, Godrej & Boyce Mfg. Co Ltd. Tooling Division, Packsys Global Bangkok, Sunbeam Auto Ltd., Gurgaon and Endurance Technologies Ltd. He has a wide exposure in design and manufacturing of large size HPDC dies e.g., Clutch Housings, Transmission case, Fly wheel housings, Cam carriers etc. (Parts from 150 to 2500ton machine size). He is a recipient of several national & international accolades & awards for his expertise in the field of Die Casting.

The Webinar received a good response from the industry. Around 70 delegates from the Corporate/MSME/ Academic Organizations across the country registered and participated in the event. The presentation & the talk by Mr. Rajesh Aggarwal was information rich, engaging & value adding and was very much appreciated by the participants. The participants had active & fruitful interaction & participation in the Webinar. The Webinar was organized by the ALUCAST Secretariat. The Webinar incepted with the Opening Remarks and ended with the Closing Remarks from Ms. Kirti Ramdasi – Secretary, ALUCAST India. Mr. Rushikesh Bhange took care of the technical support for the Webinar & Ms. Veena Upadhye provided the necessary backend support.



ALUCAST MSME Member – DST Tech Pvt. Ltd. wins the NADCA International Award for Excellence in Decorative Zinc Die Casting For The Year 2022

ALUCAST is happy to share that our MSME Member DST TECH PRIVATE LIMITED has received the coveted NADCA International Award – "Excellence in Decorative Zinc Die-casting" for the Year 2022 for their product "SENSOR HOUSING WALL PLATE".

As die casting fraternity is well aware, major usage of Zinc die-casting worldwide is for decorative electroplated products, may it be, sanitary ware, builders hardware, auto parts or fashion accessories.

The toughest challenge to produce "blemish free Chrome/ PVD surface finishes" – bigger the surface, larger the challenge. It tests everyone's ability:

1.0 Tool designer in making a good feed system for accelerated divergent flow and a thermally balanced tooling to produce a "zero defect high integrity surface" casting, which can be polished and electroplated to perfection.

2.0 Die caster for maintaining all parameters of the die casting tool/ machine and furnace in a very narrow range to have consistent results

3.0 Highly skilled polisher, not to produce any waviness on surface and do not over-polish to expose underlying shrinkage and gas porosity

4.0 And finally Electroplater - Being a minimum five layer process, herculean efforts are needed to maintain bath parameters of each process tank, keep cast surface activated during transfers and prevent process solutions contamination using ultra filters and thorough rinsing after each process.

So we received the casting design from our customer for mounting an infrared sensor. The casting top surface which is "aesthetically important" was of size 165mm x 130mm, which from the perspective of Chrome plating is a fairly large surface area

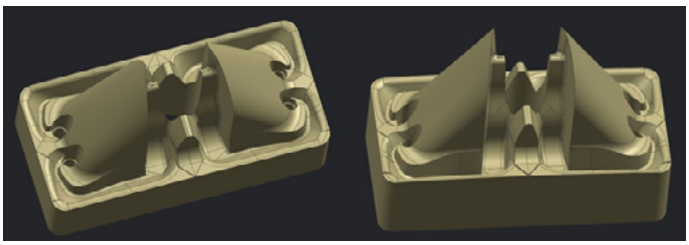
Generally, such sensor plates are made in plastic or sheet metal. These are used in auto flush urinals/bidets. However the customer chose Zinc, since polished and electroplated Zinc is aesthetically very beautiful and impressive.

To feed this casting, we used the "inner window" for feed system design and created 4 tapered channel runners for accelerated flow.

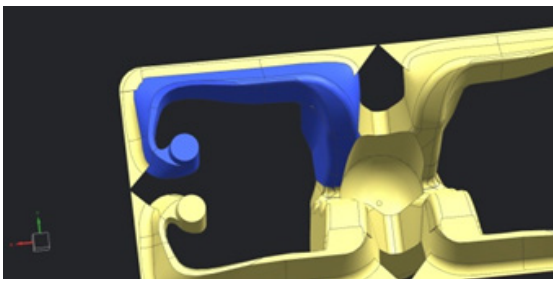
The reasons it won approval from NADCA jury were :

1.0 Very high yield > 70%. Runner weight was 35gms vis-à-vis NW of casting 400 gms

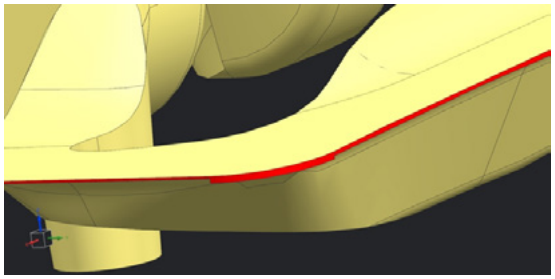
2.0 Pyramidal shaped sprue and nozzle design accommodated in small window. Conventionally designed sprues, in die casting are conical in shape.



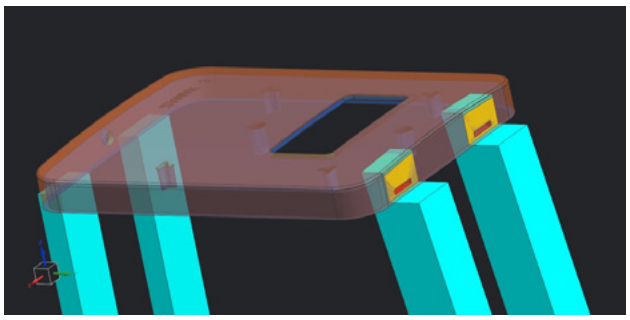
3.0 Taper runner feed system, so extensively demonstrated by NADCA and IZA.



4.0 Step gating to feed molten metal proportionate to volume of different sections and flow distance.

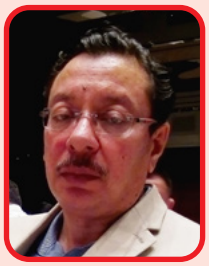


Besides above complicated feed system to fill the Casting, in the tool design itself, we had to provide for "snap locks" similar to plastic / sheet metal wall plates. To create these locks in the tool, "Slanting ejectors" were provided, which move away from these "lock projections" as the casting is ejected from the tool.



This completed the design challenge for this casting. Further we worked in the die casting shop floor to produce "high surface integrity" , under strict parameter control.

Subsequently the casting was polished and duly electroplated. It has won customer approval and is in regular production.



Sandeep Tandon
Director
DST Tech Pvt. Ltd.

ALUCAST® 2022

INTERNATIONAL EXHIBITION & CONFERENCE – ALUMINIUM DIE-CASTING
CHENNAI TRADE CENTRE, CHENNAI | DECEMBER 1-3, 2022

EVENT THEME – GREEN & SMART DIE CASTING SOLUTIONS FOR SUSTAINABILITY

TECHNICAL PRESENTATIONS FOR ALUCAST 2022 TECHNICAL CONFERENCE

Submission of the abstract for advance information of the Technical Papers Committee before Tuesday,16th August 2022 on the email address as specified. Submission of full-length paper before Friday, 16th September 2022 on the email address as specified.

Email: rushikesh.bhange@alucast.co.in

Delegate fees for ALUCAST 2022 Technical Conference:

DOMESTIC (all prices are including taxes)	
Members	₹ 9,000/-
Non-members	₹ 11,000/-
Students*	₹ 7,000/-

INTERNATIONAL (all prices are including taxes)	
Members	US $ 200
Non-members	US $ 300
Students*	US $ 100

* Students with valid ID & Recommendation Letter from the University / Institute for the current academic year.

NOTE
Delegate Registration for 3 or more Delegates from a single Organization - **Discount of 10% on the total Delegate Fees.**
Delegate Registration for 5 or more Delegates from a single Organization - **Discount of 15% on the total Delegate Fees.**

EXHIBITION SPACE BOOKING

Note: ALUCAST Membership valid till December 2022 is mandatory for participation in ALUCAST 2022 as an EXHIBITOR.

Exhibition Space Booking Fees:

DOMESTIC	
Shell Scheme	₹ 11250 per m^2 (minimum 12 m^2)
Raw Scheme	₹ 10250 per m^2 (minimum 36 m^2)
Registration Fee	₹ 2500/-
Co-exhibitor Fee	₹ 5000 per co-exhibitor (associate companies with the main exhibitor)

INTERNATIONAL	
Shell Scheme	US $ 275 per m^2 (minimum 12 m^2)
Raw Scheme	US $ 250 per m^2 (minimum 36 m^2)
Registration Fee	US $ 70
Co-exhibitor Fee	US $ 125 per co-exhibitor (associate companies with the main exhibitor)

For Space Booking, please contact :

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Event Producer

NÜRNBERG MESSE

Summary Report: Cumulative Production, Domestic Sales & Exports data for the period of April - May 2022						
Report I - Number of Vehicles						
Category	Production		Domestic Sales		Exports	
Segment/Subsegment	April-May		April-May		April-May	
	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23
Passenger Vehicles (PVs)*						
Passenger Cars	2,30,412	3,09,708	1,82,730	2,36,917	44,417	67,275
Utility Vehicles(UVs)	1,90,539	2,75,030	1,54,029	2,43,539	29,311	35,962
Vans	13,226	22,575	12,919	22,247	99	199
Total Passenger Vehicles (PVs)	**4,34,177**	**6,07,313**	**3,49,678**	**5,02,703**	**73,827**	**1,03,436**
Three Wheelers						
Passenger Carrier	1,00,597	93,281	9,995	34,732	89,114	62,364
Goods Carrier	9,738	16,202	5,123	14,748	1,784	912
Total Three Wheelers	**1,10,335**	**1,09,483**	**15,118**	**49,480**	**90,898**	**63,276**
Two Wheelers						
Scooter/ Scooterettee	4,52,701	8,26,568	3,56,792	7,86,541	66,223	63,240
Motorcycle/Step-Throughs	16,45,926	22,40,289	9,63,139	15,55,300	7,19,675	6,89,892
Mopeds	43,833	72,780	33,112	73,928	4,242	54
Total Two Wheelers	**21,42,460**	**31,39,637**	**13,53,043**	**24,15,769**	**7,90,140**	**7,53,186**
Quadricycle						
Quadricycle	902	303	-	54	960	162
Grand Total of All Categories	**26,87,874**	**38,56,736**	**17,17,839**	**29,68,006**	**9,55,825**	**9,20,060**

*** BMW, Mercedes, Tata Motors & Volvo Auto data are not available. Society of Indian Automobile Manufacturers (10/6/2022)**

Summary Report: Cumulative Production, Domestic Sales & Exports data for the period of April-June 2022						
Report I - Number of Vehicles						
Category	Production		Domestic Sales		Exports	
Segment/Subsegment	April-June		April-June		April-June	
	2020-2021	2021-2022	2020-2021	2021-2022	2020-2021	2021-2022
Passenger Vehicles (PVs)*						
Passenger Cars	4,35,618	5,10,826	3,37,191	4,11,441	79,359	1,04,400
Utility Vehicles(UVs)	3,40,853	5,17,389	2,86,092	4,64,558	47,136	55,547
Vans	24,188	34,484	22,989	34,432	588	316
Total Passenger Vehicles (PVs)	**8,00,659**	**10,62,699**	**6,46,272**	**9,10,431**	**1,27,083**	**1,60,263**
Commercial Vehicles (CVs) - M & HCVs						
Passenger Carrier	2,263	8,731	1,086	7,707	920	2,223
Goods Carrier	39,395	80,224	28,072	67,978	5,082	3,733
Total M&HCVs	**41,658**	**88,955**	**29,158**	**75,685**	**6,002**	**5,956**
Commercial Vehicles (CVs) - LCVs						
Passenger Carrier	4,912	11,494	4,297	11,590	210	274
Goods Carrier	90,356	1,56,720	72,345	1,37,237	9,794	13,247
Total LCVs	**95,268**	**1,68,214**	**76,642**	**1,48,827**	**10,004**	**13,521**
Total Commercial Vehicles (CVs)	**1,36,926**	**2,57,169**	**1,05,800**	**2,24,512**	**16,006**	**19,477**
Three Wheelers						
Passenger Carrier	1,49,308	1,44,546	15,162	50,663	1,34,392	96,038
Goods Carrier	12,409	23,260	8,661	21,350	3,190	1,199
E-Rickshaw	373	3,150	643	3,567	-	-
E-Cart	57	733	56	713	-	-
Total Three Wheelers	**1,62,147**	**1,71,689**	**24,522**	**76,293**	**1,37,582**	**97,237**
Two Wheelers						
Scooter/ Scooterettee	7,05,259	12,76,473	6,04,291	12,07,903	90,218	96,775
Motorcycle/Step-Throughs	27,23,345	34,50,846	17,40,308	24,05,228	10,41,989	10,51,477
Mopeds	63,486	1,07,106	69,009	1,11,402	4,968	342
Total Two Wheelers	**34,92,090**	**48,34,425**	**24,13,608**	**37,24,533**	**11,37,175**	**11,48,594**
Quadricycle						
Quadricycle	1,648	501	-	101	1,625	396
Grand Total of All Categories	**45,93,470**	**63,26,483**	**31,90,202**	**49,35,870**	**14,19,471**	**14,25,967**

*** BMW, Mercedes and Volvo Auto data is not available # Daimler & Scania data is not available. Society of Indian Automobile Manufacturers (13/07/2022)**