ALUMINIUM GDC TECH
GREAT DIE CASTING

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Energy Saving Using Sivex Fc Filers

The increasing use of non-ferrous metals for more sophisticated applications has led to ever greater demands for major improvements in metal quality. To remain competitive, foundries now have to be more cost conscious and the production of reject parts particularly at the machine shop stage, being costly, is therefore, unacceptable. A major development which has gained acceptance over recent years is that of foam filtration and continual product development allied to improved understanding of applications can now offer the non-ferrous foundry industry even greater savings.

The development of non-ceramic SIVEX FC filers, which can be safely and simply separated during re-melting has made foam filters easier to use. This in addition to the direct pouring application of the product offers the foundry industry improved quality combined with reduced manufacturing costs.

The potential offered by foam filters is such that the Energy Technology Support Unit commissioned a study as part of the UK Department of Environment's Energy Efficiency Best Practice Programme. The study was made at five foundries looking in details at quality, energy and labour costs using both conventional running systems and with SIVES FC filters.

Copied of this Case Study (No. 228) are available from:
Energy Efficiency Enquirieis Bureau, ETSU, Harwell, Didcot, Oxfordshire OX11 ORA
Tel: +44 01235436747 Fax: +44 01 235433066
Telex: 83135

Below is an extract taken from this publication

The use of filters for molten metal in non-ferrous foundries

Ceramic Filers

Filtering liquid metal prior to casting can provide a cost-effective way of improving product quality and reducing operating costs. Despite this many foundries still do not use filers generally because they are unaware of the overall cost benefits that they offer.

These case studies describe the benefits achieved by five foundries using ceramic filters in the manufacture of castings. Four of the foundries cast mainly aluminium. While the other is almost completely devoted to the production of copper-based alloy castings. The benefits achieved include lower scrap and reject rates improved quality and reduced energy, metal sand and labour costs.

The increased use of filters in UK non-ferrous foundries could realistically save almost £ 6 million/year of which energy contributes £ 1 million/year.

Savings achieved

The total energy cost saving for the five products monitored was approximately £ 3,000/year for 30 toners of good castings produced. Non-energy related savings of over £ 15,000/year were also achieved. For each castings, the total cost savings ranged from £ 2,100 - £ 5,500/year.

Background

Foundries are under increasing pressure to improve the quality and reduce the cost of their castings. One way of achieving this is by filtering liquid metal in the down sprue or runner bar. This allows are rate of flow to be controlled while removing entrained debris for example metal oxides and small pieces of mould, cores, ladle and furnace lining which would otherwise remain as inclusions in the castings.

Fiberglass and steel screens have been used for many years but more recently ceramic filters have become available. However, many foundries do not use filers at all. The aim of these Case Studies is to show how five foundries differing in size, proves and product use filters to reduce their operating costs.

The benefits vary depending on the casting, the process and the foundry but normally include:

- Reduced scrap and reject rates
- Improved customer confidence
- Higher overall yields
- Reduced energy, metal sand and labour costs.

The cost of adjusting patterns or dies to accommodate the filters is minimal. The actual filters cost less than £1 each.

The monitored sites

Five foundries using ceramic filters in their castings were monitored.

Economics

The five products monitored achieved total energy saving of 931 GJ (primary energy) for 25.4 tonnes of good finished castings this equates to 36.65 GJ/tonne of good castings worth £ 210/tonne. Total cost savings were £ 638/tonne.

The cost of installing the filters was minimal, giving rapid payback periods – a few days to a few weeks – on all five products.

National potential

Annual UK aluminium castings production includes 50,000 tonnes made in gravity dies and 15,000 tonnes in sand moulds. Assuming that only one third of these currently have efficient filters in the running systems and that 20% of the remainder could benefit from their use, total cost savings of approximately £ 5.5 million/year could be achieved by UK foundries of this energy saving of more than 300,000 GJ would contribute £1 million/year.

The production of castings in copper base alloys is much lower. However increasing the use of ceramic filters to another 1,100 tonnes of castings would result in cost savings of approximately £ 500,000 /year.

Comments from the monitoring consultant

The pressure on foundries to provide castings of high quality at low cost has never been greater. Buyers today expect levels of quality and service which far exceed those of even a decade ago. Foundryman, therefore, must conform to this concept of continual improvement or go out of business. The foundries which have co-operated in this case study have all shown a way in which they have improved customer satisfaction whilst enhancing their own profitability. They have made excellent use of ceramic filters in the running systems of the casting illustrated.

Cost savings have been achieved in many different areas in melting less metal in lower metal losses in reduced levels of chemically bonded sand required etcetera, Energy savings, whilst significant are seldom the major element of financial gain. The estimated of saving are, if anything understated and many other real benefits cannot be quantified.

I hope that this case study will encourage all non-ferrous foundries to consider how they can benefit from the use of filters.

Mr. S. D. Apsley
Monitoring consultant.

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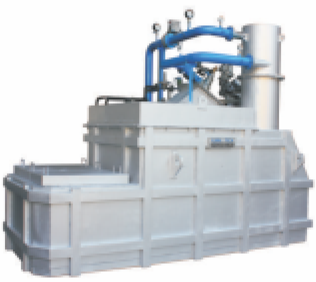

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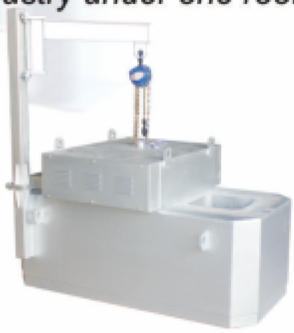

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Statistical Techniques for Industry

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23. Specific cases in context of process, Part II

....Continued from October 2019 Issue

Illustrative Example for modifications in control limits.

An illustrative example will be useful to understand the application of modified control limits. Table 23.02 shows data for Flange Thickness 52.0 +/- 0.15 mm measured on 25 samples of size n = 5 Nos. As a starting point the standard control charts for mean and for range are plotted which are shown in Figure 23.02 and Figure 23.03 respectively. The calculations for standard control charts are shown below, which will help readers to understand the subject more clearly.

Primary calculations

Tolerance (T) = 0.3 mm.
Sample size n = 5.
Maximum observation = 52.04 mm.
Minimum observation = 51.96 mm.
Range = 0.08 mm.

Calculations for the control chart

Process mean X double bar = 52.005 mm Where

$$\overline{\overline{X}} = \frac{\overline{X}_1 + \overline{X}_2 + \overline{X}_3 + \cdots + \overline{X}_k}{k} = \sum_{k=1}^{k} \overline{X}_j/k.$$

Mean range (R bar) = 0.0472 mm Where

$$\overline{R} = \frac{(R1+R2+R3+\cdots+Rk)}{K} = \sum_{i=1}^{K} \frac{Ri}{k}$$

Standard deviation σ = 0.0203 mm Where

$$\sigma = \overline{R}/d_n \text{ or } \overline{R}/d_2$$

Control limits for Mean chart

Upper Control Limit = X Double Bar +A2RBar
UCL = 52.032 mm

Lower Control limit = X Double Bar -A2RBar

LCL = 51.977 mm

Control limits for Range chart

Upper Control Limit = D4 R bar
UCL = 0.0996 mm
Lower Control Limit = D3 R bar
LCL = 0.0 mm

Constants for control chart for n = 5

dn or d2 = 2.326
A2 = 0.58
D3 = 0.0
D4 = 2.11

Capability indices of this process

Before going ahead, let us have a look on capability indices of this process.
Cp = 2.464
Cpku = 2.385 and Cpkl = 2.543
Hence; Cpk = 2.385
In this case the natural spread i.e. 6 times standard deviation is;
6σ = 6 X 0.0203 =0.1218 mm

Observations about the control charts

- Both the range chart and mean chart show that the process is in control.
- The control limits for the mean chart (UCL = 52.032 mm and LCL = 51.977 mm) are 0.0548 mm apart which are quite close as compared to the specification limits.
- The natural spread of the process is very small as compared to the specified tolerance of 0.30 mm. This is seen by the value of index Cpk = 2.385. The tolerance band of 0.3 mm is about is about 15 times of the standard deviation of 0.0203 mm. In other words, the tolerance is equal to 15σ. This process is +/- 7.5sigma process.

Since the tolerance band is quite larger than natural variability of the process, the control limits for mean chart calculated based on Shewhart method appear to be too closer. In this situation one can think of modification in control limits.

Modified control limits for approach #1

In this case the process mean is allowed to shift by +/- 1.5σ around the target value of 52.0 mm.

The shifted process means are as follows;

X Double bar upper = Target + 1.5σ

X Double bar upper = 52.0 + 1.5(0.0203)

X Double bar upper = 52.0304 mm

X bar lower = Target - 1.5σ

X bar lower = 52.0 - 1.5(0.0203)

X bar lower = 51.9696 mm

The modified control limits are as follows;

$$UCL = (Target + 1.5\sigma) + A2\ R\ bar$$

UCL = 52.0304 +0.0274

UCL = 52.0578 mm

$$LCL = (Target - 1.5\sigma) - A2\ R\ bar$$

LCL = 51.9696 - 0.0274

LCL = 519422 mm

The mean chart plotted with these modified control limits is shown in Figure 23.04.

We can find that the modified control limits are 0.116 mm apart, whereas for the standard chart these were 0.0548 mm apart only.

Modified control limits for approach #2

In this case the process mean is to be allowed to vary by a distance of zσ from the specification limits. The value of z is selected based on the desirable value of allowed rejection. Let us consider allowable rejection of about 3 PPM. As shown in Figure 23.01, for z = 4.5, the out of specifications parts will be 3.4 PPM for one end of the normal distribution curve. Since for the other end of the curve, the value of z will be 7.5 (12 – 4.5), the out of specification parts will be practically Zero.

The shifted process means are as follows;

X Double bar upper = USL- zσ

X Double bar upper = 52.15- 4.5(0.0203)

X Double bar upper = 52.0587 mm

X Double bar lower = LSL + zσ

X Double bar lower = 51.85 + 4.5(0.0203)

X Double bar lower = 51.9413 mm

The modified control limits are as follows;

$$UCL = (USL - z\sigma) + A2\ R\ bar$$

UCL = 52.0587 + 0.0274

UCL = 52.0861 mm

$$LCL = (LSL + z\sigma) - A2\ R\ bar$$

LCL = 51.9413 – 0.0274

LCL = 51.9139 mm

The mean chart plotted with these modified control limits is shown in Figure 23.05.

We can see that the modified control limits with this approach are 0.1721 mm apart, whereas for the first approach these were 0.116 mm apart only.

In the first approach we allowed the mean is to shift by +/- 1.5 sigma from the target value; whereas in the second approach the mean is allowed to shift by 4.5 sigma from the specification limits. For a +/- 6 sigma process the control limits with both the approaches will be at same position if the allowed shifts are as above. In this example, since the process is +/- 7.5 sigma, the control limits with second approach are wider than those arrived with the first approach. Naturally the rejection with the first approach will be quite less than the predicted value of 3.4 PPM.

It is important to understand this logic, otherwise one may have a undesirable situation of more rejection, due to greediness for wider control limits.

What we learned?

- For a process with good capability (Cp and/or Cpk = 2 or more) the control limits often appear too close as compared to the specification limits. Such situations can result in unnecessary interventions in the process. Modified control limits can be used in such situations.

- The correctly centered process with the specifications equal to X bar +/- 3σ will produce 0.27% or 2700 PPM defects. This process can be referred as "an unshifted +/- 3 sigma process" and the quality can be called as "+/- 3 sigma quality".

- Result of +/- 1.5 σ shift on +/- 6 sigma process with Normal Distribution will be 3.4 PPM rejection. This forms a basis for modifying the control limits.

- Two approaches are common for modifying the control limits. In first approach the process mean is allowed to vary by +/- 1.5 sigma. In second approach the process mean is allowed to vary by a distance of zσ from the specification limits. The value of z is selected based on the desirable value of allowed rejection.

- Modified control limits help in avoiding unnecessary stoppage of production for finding out the probable reason for shift as well as applying the corrective actions. Thereby the process is allowed to follow its natural pattern which helps the process to remain stable.

- For inconsistent and unstable process, modified control limits are not appropriate. For this reason a range chart or standard deviation chart should be used in conjunction with the mean chart.

- When the capability of a process is not known, modified control limits can not be applied. For this reason these can not be applied on a totally new process.

Acknowledgements

- I would like to acknowledge my Guru Mr. S B Deo, who taught me 'Statistical Process Control'.

- Online Statistics Education: A Multimedia Course of Study (http://onlinestatbook.com/). Project Leader: David M Lane, Rice University.

Sample No.	i	ii	iii	iv	v	X Bar	Range
1	52.040	52.020	52.020	52.040	52.000	52.024	0.0400
2	51.980	52.000	51.980	52.000	52.000	51.992	0.0200
3	52.040	52.020	52.020	52.020	52.000	52.020	0.0400
4	52.020	52.020	51.960	52.020	51.960	51.996	0.0600
5	52.020	52.020	52.020	51.980	51.980	52.004	0.0400
6	52.020	51.960	52.000	51.960	52.000	51.988	0.0600
7	52.040	52.020	52.020	52.020	51.980	52.016	0.0600
8	52.020	52.000	52.020	52.020	52.000	52.012	0.0200
9	52.040	52.020	51.980	51.980	52.020	52.008	0.0600
10	52.000	52.000	52.020	51.960	52.020	52.000	0.0600
11	52.040	52.000	52.020	52.000	52.020	52.016	0.0400
12	52.020	51.960	52.020	51.960	52.020	51.996	0.0600
13	51.960	52.020	51.960	51.960	52.020	51.984	0.0600
14	52.040	52.000	52.020	52.000	52.020	52.016	0.0400
15	52.020	52.020	51.960	51.960	52.020	51.996	0.0600
16	52.020	52.000	52.020	52.000	52.020	52.012	0.0200
17	51.960	52.020	51.960	51.960	52.020	51.984	0.0600
18	52.040	52.020	52.020	52.020	52.000	52.020	0.0400
19	52.040	52.020	51.980	51.980	52.020	52.008	0.0600
20	52.020	52.040	52.040	52.020	52.020	52.028	0.0200
21	52.020	51.960	51.960	51.960	52.020	51.984	0.0600
22	52.040	52.020	52.020	52.000	52.000	52.016	0.0400
23	52.040	51.980	52.020	51.980	51.980	52.000	0.0600
24	52.040	52.020	52.020	52.000	52.000	52.016	0.0400
25	51.960	52.020	51.960	51.960	52.020	51.984	0.0600
					Σ	1300.120	1.180
					X double Bar	52.005	
					R Bar		0.0472

Table 23.02: Flange Thickness measured on 25 samples of size 5

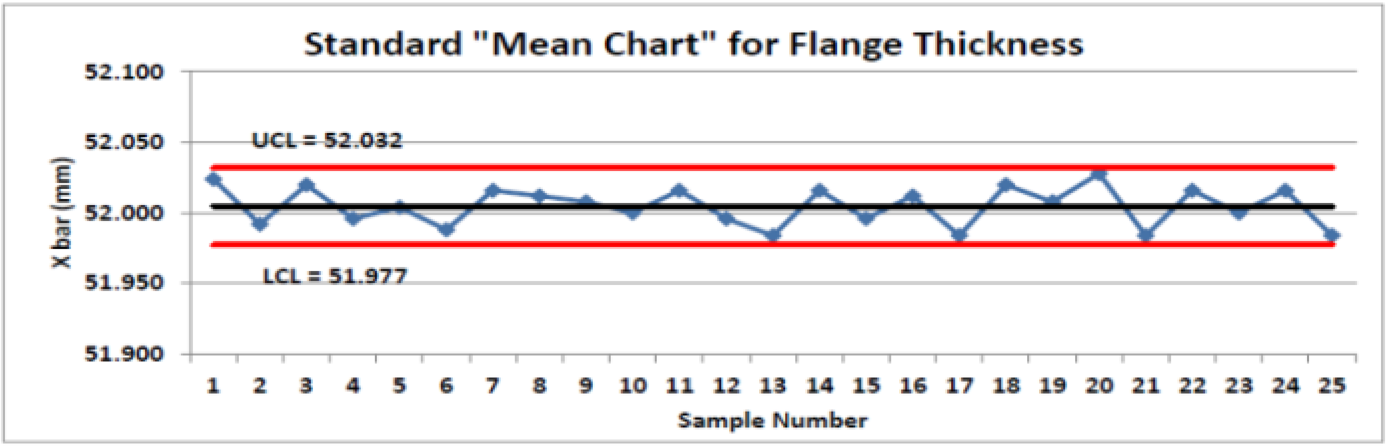

Figure 23.02: Standard “Mean Chart” for Flange Thickness

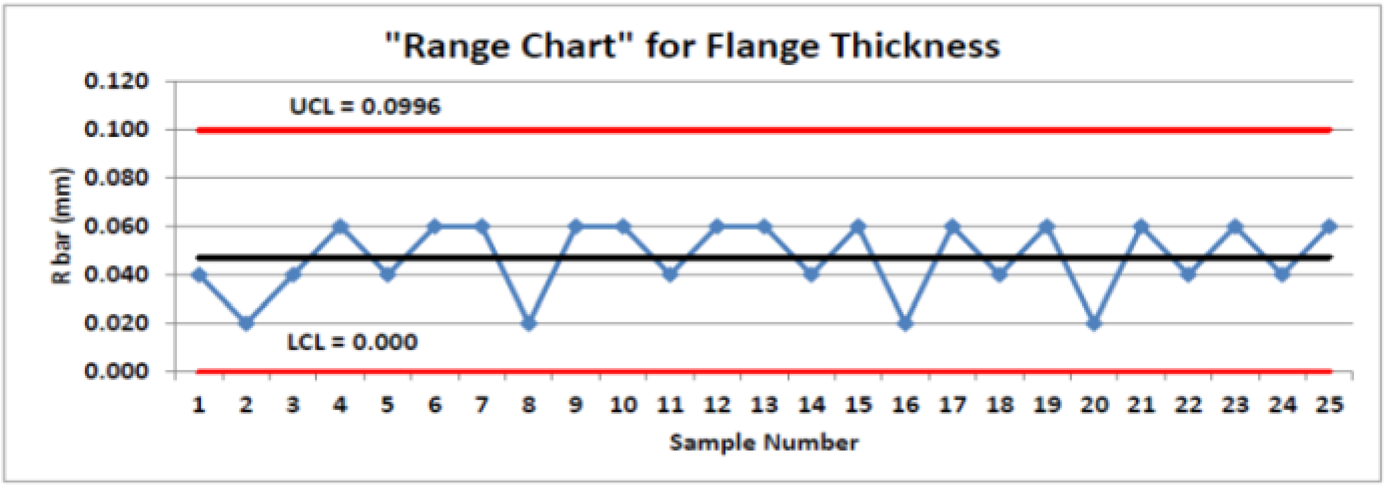

Figure 23.03: “Range Chart” for Flange Thickness

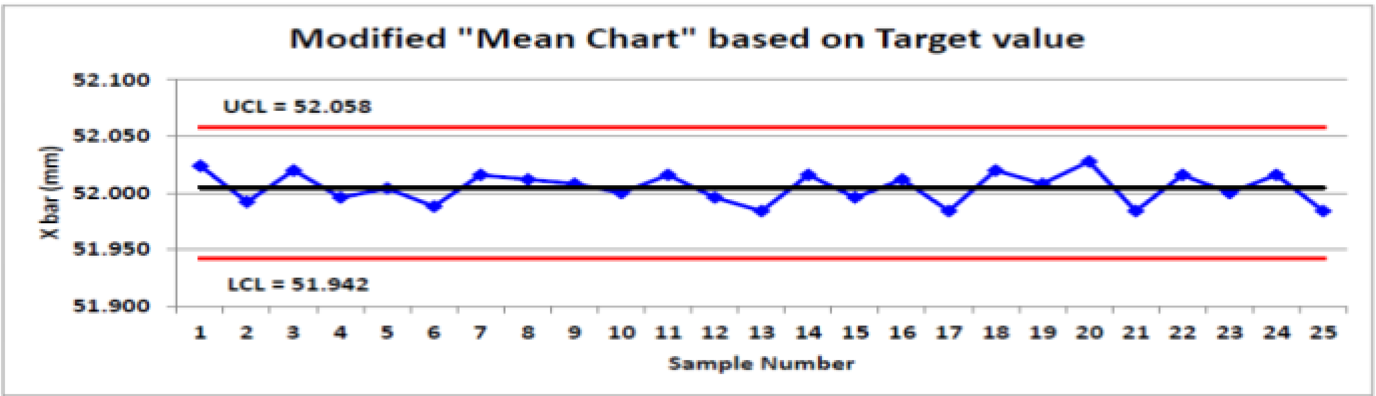

Figure 23.04: Modified “Mean Chart” for Flange Thickness based on Target value

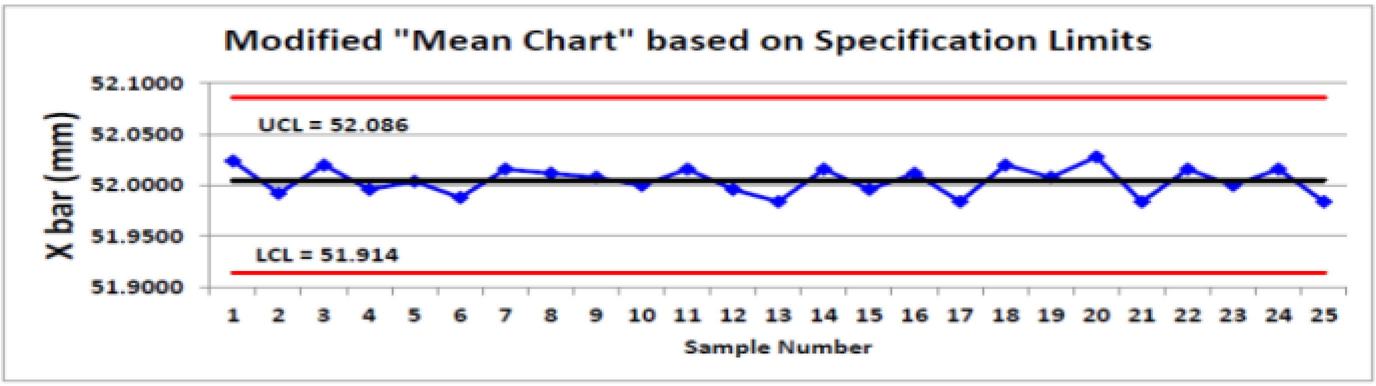

Figure 23.05: Modified “Mean Chart” for Flange Thickness based on Specification Limits

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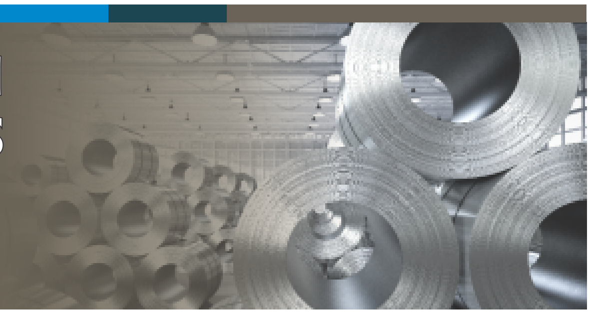

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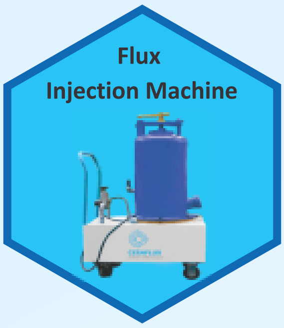

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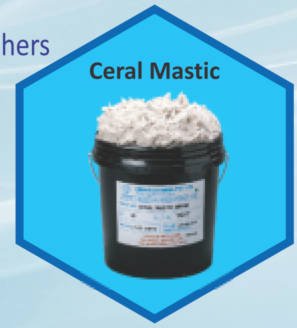

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Integrated modelling of deformations and stresses in the die casting and heat treatment process chain

....Continued from October 2019 Issue

6 Casting process

The casting process was simulated as a first step, to predict the distortion before heat treatment. Figure 4 shows the evolution of the stress levels during the casting process and how the displacements build up at the same time. The von Mises stress distribution is shown above the process view and the displacements are shown below the process view. Starting from left, the results show the conditions just before die open, just afterejection, at ambient temperature and nally after trimming. In the first result the stress level is governed by the constraints from the die and the chosen die open time, Figure 4a. Evaluating this result makes it possible to analyze, if critical stress levels are reached, which could promote large permanent deformations or even affect the ejection process. After ejection the stress level is significantly reduced, which is seen in the second result, Figure 4b. During the subsequent cooling step to room temperature moderate stresses are generated due to the thermal gradients, see the third result, Figure 4c, and only small changes are seen in the subsequent trimming step, Figure 4d.

Evaluating the distortion at the same points in time shows how the main distortion evolves during the cooling step from die open to room temperature. Only a limited amount of distortion is observed just before die open, Figure 4a,due to the constraints from the die. Just after the ejection process some distortion is seen, mainly due to elastic spring back when the constraints from the die are removed, Figure 4b. The free thermal contraction from die open to ambient temperature generates a significant amount of distortion, Figure 4c. For this reason it can be useful to make variations in the die open time to investigate how much the free contraction affects the thermal distortion level. For this example, thermal trimming step does not change the distortion significantly, Figure 4d. However, depending on the gating system and the design of the part, this thermal step can contribute to the distortion level.

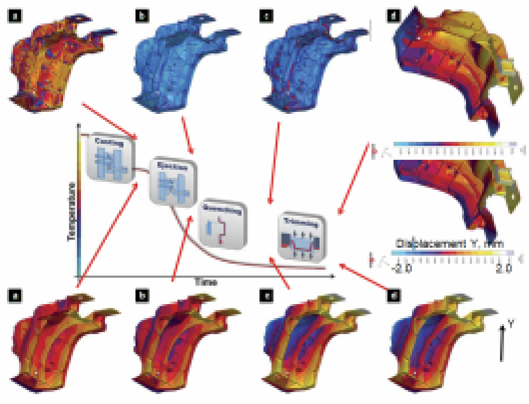


Figure 4: Evolution of von Mises stress (upper row of results) and displacement in Y-direction (lower row of results) during the different HPDC process steps. From left, the results are shown at different process times just before die open (a), just after ejection (b), at ambient temperature (c) and finally after trimming of the gating system (d).

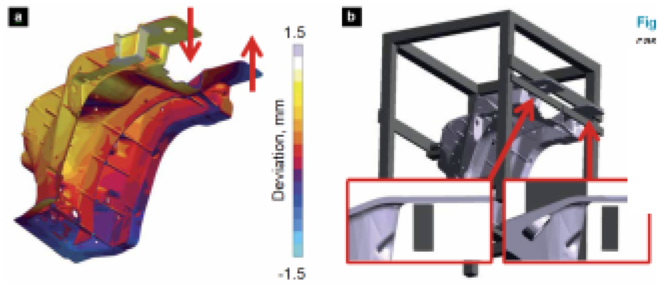


Figure 5: Deviation of the casting from the reference geometry after trimming at room temperature (a) and support frame designed to compensate for the casting distortion during heat treatment(b).

7 Heat treatment and support structure design

The thermal distortion after casting was used to design the support frame for the subsequent heat treatment steps. It was clear from the calculated distortion, Figure 5a, that the upper left corner bends downwards whereas the upper right corner bends upwards compared to the reference geometry. The directions of bending are indicated by the two arrows.

This type of unwanted distortion can in most cases be reduced by allowing the structure to deform in a controlled way during solution treatment. As the temperatures are close to solidus, small forces from gravity promote creep in regions

where the support frame does not restrict the deformation. The amount of obtained creep, and by that distortion , in the structure depends on the temperature level and the process time. The temperature must be sufficiently high to activate creep and the frame must be carefully designed to allow wanted distortion and restrict unwanted distortion.

The temperature must be sufficiently high to activate creep and the frame must be carefully designed to allow wanted distortion and restrict unwanted distortion.

For the considered example the frame was designed as shown in Figure 5b. The zoomed-in view in the box at the right shows how the part initially has a gap between the upper right plate and the bar in the frame just below it. This freedom to deform is designed to allow the two plates to align at the end of solution treatment.

Results from the casting process are mapped to the position of the part in the support frame, Figure 5b. This step is done automatically in Magmasoft, i. e. all relevant mechanical fields are transferred from the orientation in the casting process to the orientation in the heat treatment process.

8 Stress development during heat treatment

During the heat treatment process, the stress level in the part significantly changes due to the elevated temperature levels and the cooling conditions. To illustrate the influence on the considered part, several von Mises stress results are shown in Figure 6, where the initial stress level is based on the mapped results from the casting simulation. As expected, the stresses are relaxed to almost zero during solution treatment, where the temperature level is approximately 460 °C. The subsequent cooling only leads to a small increase in the stress level, and in the nal aging step, at approximately 220 °C, the stresses are again relaxed to an even lower level at the end of the entire heat treatment process.

9 Distortion evaluation after heat treatment

The results in Figure 7 show the obtained distortion after heat treatment and the deviation from the reference geometry after casting and after heat treatment. The designed gap in the support frame clearly allows the wanted deformation to develop during solution treatment and by that to actively compensate for the casting distortion. The level in deviation from the reference geometry was reduced by approximately 1.5 mm, see Figure 7 below.

10 Validation of results using optical measurements

The obtained correction to the casting distortion was compared to measurements. Figure 8 shows the distortion of the cast part after the full process chain of casting and heat treatment. The curves show the deviation at multiple measurement points from the reference geometry. The red curve shows the Magmasoft-simulation result, where the blue, yellow and green curves show measurement results for 3 different specimens of the part.

The predicted results show a very good agreement to the measurements in almost all areas. Differences mainly appear in the red marked areas, where the measurement points are located very close to the outer bounds of the geometry. In these outer regions, mechanical influences from e. g. handling and trimming are very likely to have influenced the measured results. In one case (detail on the right) an artificial indentation in the imported stl-geometry, containing the measured shape,is responsible for the shown deviation to the simulation result.

Overall, the agreement between simulation and measurements is very good and the applied simulation approach has been useful to analyze the distortion problem during casting and the subsequent heat treatment processes.

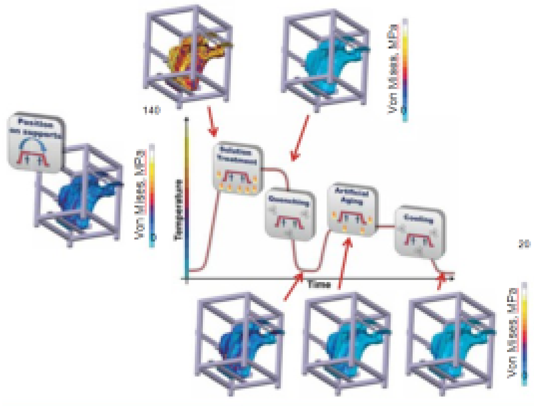


Figure 6: Evolution of von Mises stress at different points in time during the heat treatment process. Notice the different stress scales due to the different ranges of the stress levels.

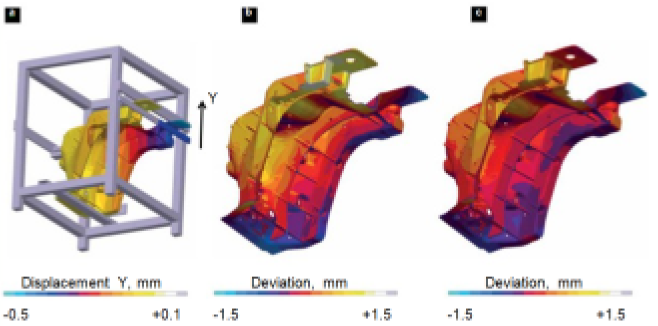


Figure 7: Distortion in the direction of gravity (a), deviation from the reference geometry after casting (b) and deviation from the reference geometry after heat treatment ©

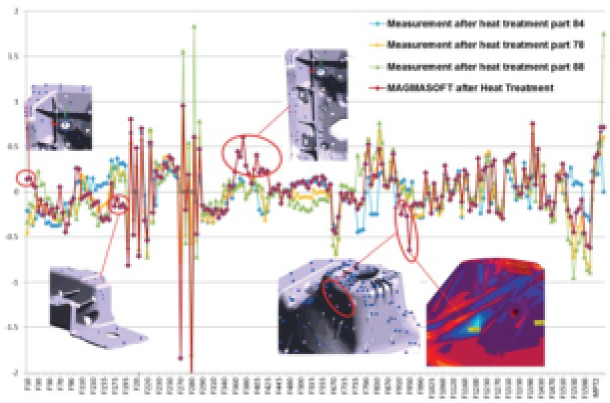


Figure 8: Measurements compared to results of the simulated deviation from the reference geometry for more than 50 measurement positions. Notice the measurements contain a spread in the level for the three considered parts.

11 Straightening and the risk of deforming the part at room temperatureDistortion after casting and heat treatment is typically corrected by different types of straightening processes. The needed corrections to get sufficient accuracy in the final shape are obtained by applying high mechanical loading to produce localized permanent deformation in different regions of the structure. Today, state-of-the-art straightening is done in a fully automatic process where several steps of pushing, pulling and twisting can be applied to the part in different directions. The most advanced systems are based on self-learning algorithms to reduce and optimize the required number of correction steps. The straightening process provides a high level of freedom to correct the part, but the mechanism behind the process is to plastically deform the material at room temperature, which in the worst case can influence the mechanical performance during service loading. Especially if several big correction steps are needed to obtain the required tolerances, the risk of provoking cracks and defects increases. To illustrate the impact of the straightening process, a force is applied to the shock-tower to compensate for the uneven bending of the two upper plates. The setup is illustrated in Figure 9, where the dark gray cylinders are mechanical constraints and the red cylinder indicates the location of the applied load.

The displacement result in Figure 10a shows the distortion during loading, which is approximately 9 mm in the area close to the applied load. The obtained distortion after unloading is shown in Figure 10b and is approximately 1.1 mm. During loading significant stresses build up in the part, which can be seen in Figure 11. Stress results during and after loading are shown in Figure 11a and Figure 11b, respectively. As a consequence of the high loading, localized permanent deformation is generated inside the part, which can clearly be seen in the highlighted regions in Figure 12. The initial deviation to the reference geometry after casting is shown in Figure 13a. The deviation which was possible to obtain by designing the support frame for heat treatment is shown in Figure 13b, and the deviation obtained from the straightening process is shown in Figure 13c. The deviation in the two results Figure 13b and Figure 13c are to a large extent in the same range.

The example shows how simulated distortion can be used in the design strategy of the heat treatment support frame to promote distortion during solution treatment, which actively compensate for casting distortion. This approach can be used to reduce the required amount of straightening steps at the end of the process chain, which reduces costs and the risk of generating defects and increased residual stresses in thermal part.

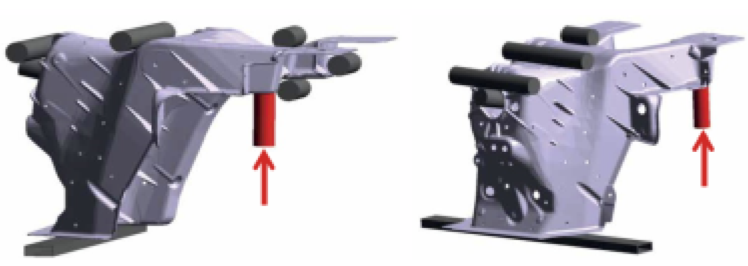


Figure 9: Setup for modeling the straightening process. The dark gray cylinders are constraints and the red cylinder indicates the location and direction of the applied load.

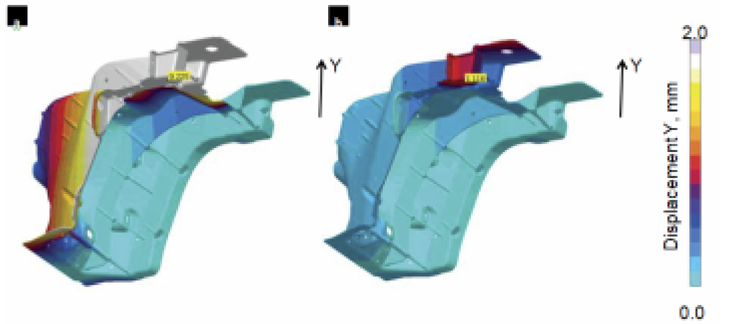


Figure 10. Deformation during straightening (a), obtained deformation after straightening (b).

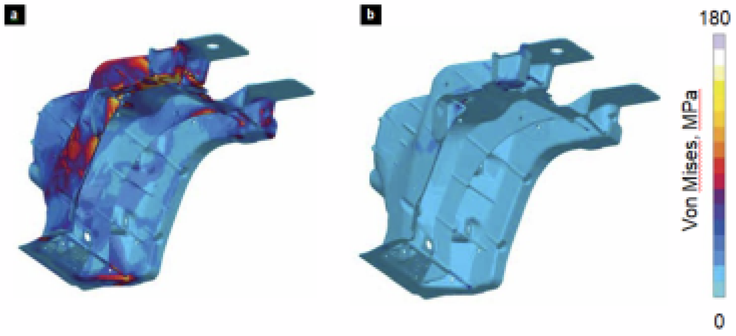


Figure 11. Von Mises stress during straightening (a), Von Mises stress after straightening(b).

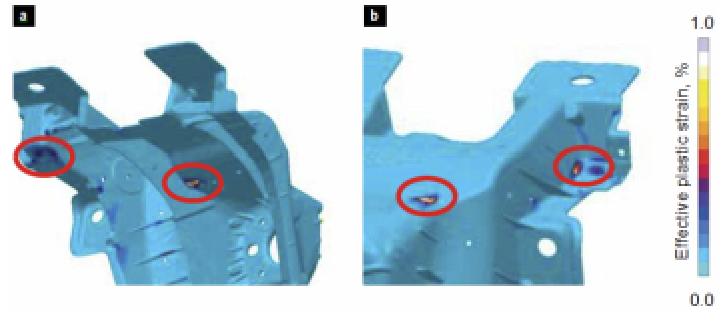


Figure 12: Effective plastic strain on the inner side (a), effective plastic strain on the outer side (b), both after straightening. The results show the localized permanent deformation which was generated during straightening.

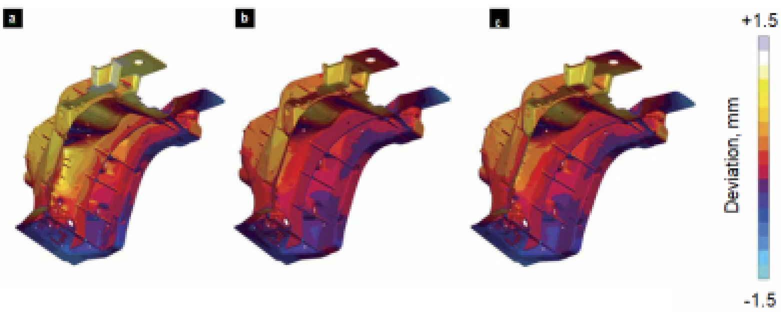


Figure 13: Deviation from the reference geometry after casting (a), deviation from the reference geometry after heat treatment (b) and deviation from the reference geometry after straightening (c).

...To be Continued in Next Issue

Recycling Aluminium Swarf / Chips By Briquetting For Greater Efficiency

Romy Wadhwani & Sunil Makhijani - Partner & General Manager
Email: romysw@gmail.com

Recycling Aluminium swarf / scrap effectively to facilitate easier handling is becoming more relevant in India. Leading automobile and auto component manufacturers around the world are recycling plant metallic waste by briquetting to reduce logistic costs & improve profits.

Briquetting aluminium swarf /chips has many benefits and the payback period of an energy efficient Briquetting Press is short.
Through recycling aluminium scrap by briquetting, resources can be conserved, energy cost reduced and the plant can be kept clean and safe.
The advantages of briquetting aluminium scrap are:
- Energy savings
- Volume reduction
- Recovery of the expensive cooling lubricant
- Reduction of logistics costs
- A clean production
- A contribution to resource and environmental protection
- Increase in Value

Furthermore, the melting efficiency increases by briquetting of scrap. Typically, when loose aluminium chips / swarf are charged in fuel fired melting furnaces, melt losses are upto 20%. By using briquettes of aluminium scrap, melt losses are reduced to 2-3%.

Briquetting for greater efficiency and profitability:
RUF's briquetting Press helps the automotive supplier ZF Gusstechnologie GmbH to operate in a more efficient way. With the help of RUF units, the pressure die-casting specialist recycles the aluminium chips, generated at their plant, into solid briquettes and also frees them to a great extent from adhesive cooling lubricants.

The company saves a lot of space and logistics expenditures, avoids lubricant carryover, protects the environment and increases the sales revenues. The briquettes are sold at a higher price than the aluminium chips.

The Payback Period of a RUF Briquetting Press is short – usually within a year for Aluminium swarf / chips.

Bulk volume reduced to one tenth – increased revenues
Andreas Dotterweich, Manager at ZF Gusstechnologie, explains: “The most significant benefits of briquetting lie in the space savings, the environmental friendliness and in avoiding lubricant carryovers.” The figures concerning space savings and the accompanying simplified handling speak for themselves. The bulk volume is lowered significantly through briquetting: For loose milling chips, it lies at around 140 to 150 kg/m3. This means that they use up about seven cubic meters of space per ton. The aluminium briquettes, on the other hand, only fill up slightly less than a tenth of this volume. Accordingly, less storage space is needed and this also leads to lower transport costs.

Metal chips and cooling lubricants are separated:
Briquetting leads to an almost complete separation of metal and cooling lubricants. In the collecting tanks, where the chips are collected at the machining centres, a part of the emulsions already drips off and accumulates in a double bottom. By the time the chips are filled into the briquetting system at ZF, the cooling lubricant proportion lies at around 20 percent. During briquetting, more of the emulsion is pressed out, lowering the residual moisture in the briquettes to about three percent. This ensures that no cooling lubricants leak out during further transport and storage.

The cooling lubricant which is pressed out is collected in a pan below the pressing chamber, pumped into collecting tanks from there and then disposed of. It can, be worthwhile for some plants to filter and reuse the pressed-out oils, especially for plants which use pure oils as cooling lubricants.

Aluminium Chips double their value in briquette form:

By briquetting the Aluminium chips at their plant Keiels Formenbau GmbH have simplified their operations and also reduced costs considerably. The chips from milling are recycled into briquettes with a RUF Press. The Aluminium briquettes are sold for double the price of loose chips.

Fig. 1: Briquettes from RUF Press at Keiels Formenbau GmbH

Higher yield

Melting down briquettes, compared to loose shavings and chips, the burn-up is significantly lower resulting in a higher melting yield. Aluminium chips from processing aluminium die-cast parts at a plant in Japan are recycled by a RUF Press at Japan. The briquettes from the RUF Press have a density of 2.2 kg./l and a residual moisture level of under 3%. The briquettes are melted directly and the yield has increased.

High yield, low space requirement, simpler production process

MT Comax acquired the first RUF Briquetting System RUF 75/2500/150, in 2014 (1.5 tons of Al chips / hour). As the amount of loose chips increased constantly, the company invested in another system, the RUF 90/2500/150 in 2017, with a capacity of upto 2 tons of aluminium chips per hour.

The high density of the briquettes of around 2.2 kg/l is extremely important for the optimum yield from the melting process.

Zollner AG compresses more than 100 tons of aluminium chips per year using a RUF briquetting press. RUF's Briquetting Press increases the efficiency of Zollner's aluminium production.

GLEICH, the specialists in high-quality aluminiumcast plates, has 6 RUF briquetting machines and they compress on average 3,800 tonnes of swarf per annum. As a result of briquetting, the volume of production waste is reduced to a fraction of the volume of the loose swarf.

The Briquetting Machines operate 24 hrs / day, in auto mode. Only the collection containers for the aluminium briquettes have to be replaced manually. The swarf is collected using a central suction device with two cyclone separators that can be alternated as required. A briquetting machine is positioned beneath each separator.

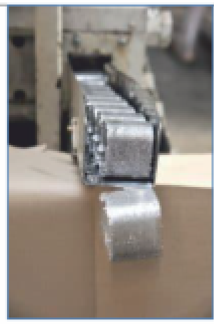


Fig. 2: Briquettes with a cross section of 60 x 60 mm make their way to the collecting containers via the outlet rails.

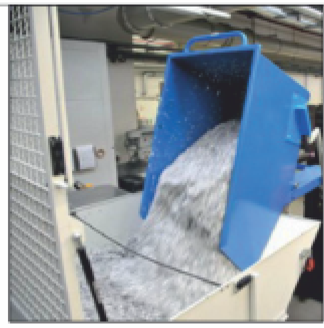


Fig. 3: Aluminium chips are collected, transported to the briquetting press and emptied into a hopper with a forklift at Zollner.

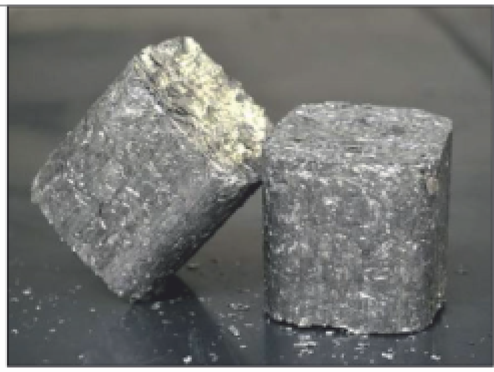
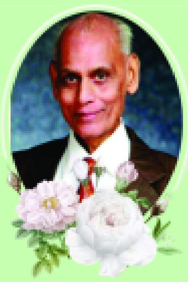


Fig. 4: The 60 x 60 mm sized aluminium briquettes have a higher sales value than loose chips. Ruf Maschinenbau GmbH & Co. KG, Germany.

Fig. 5: Briquettes coming out of RUF Press in India

Recycling Aluminium Chips / scrap by briquetting improves plant operations and increases profits. Briquetting adds value, makes it easier to handle plant metallic waste and is also good for the environment.
References: RUF Maschinenbau GmbH & Co.KG

Fig. 6: Model from the metal press series



SHRADDHANJALI

Shri. Sitaram B. Shah

Husband of Veena S. Shah and father of Vandan Shah
Managing Director of Veena Die Casters & Engineers Pvt. Ltd.
left for heavenly abode on 6 of November 2019.
An excellent technocrat and great human being , he will be missed by the Aluminium Die Casting fraternity.

Report On
International Conference & Exhibition On GDCTECH 2019
28-30 November 2019 at Chennai

Event started with welcome address by Dr. Aniruddha Karve, Chairman, GDC Tech Forum, Managing Director, Molten Metal Systems, Morgan Advanced Materials Inc. and inaugurated at the hands of Mr. L Ganesh, Chairman, Rane Group. The keynote address was delivered by Dr. V. Sumantran, Chairman, Celeries Technologies (Former-CEO Tata Motors-Car Business). In his inaugural address, Mr. L. Ganesh narrated the story of his company's growth in the last 80 years. He mentioned that traditionally we have learnt that land, labour and capital are the classical factors of production, but stressed that today, more and more labour is not just physical but also intellectual, the outcome of which is innovation and intellectual capital or wealth. He said that apart from the digital economy this is applicable even in the brick and mortar manufacturing sector. He spoke about how innovation is becoming the true differentiator between winners and others, and defined innovation simply as a "new idea, device or method". However, he said that innovation is often also viewed as the application of better solutions that meet new requirements, unarticulated needs, or existing market needs.

Dr. V. Sumantran, in his keynote address, stressed upon the need and necessity of lightweighting and Electric Vehicles. He narrated his journey with the auto industry.

Trophies were presented to the winners of the **Best Design Competition** at the hands of Chief Guest Mr. L. Ganesh

- HPDC- Dietech India (P) Ltd.
- GDC - Vulkan Technologies Pvt. Ltd.
- LPDC - Aakar Foundry Pvt. Ltd.

Mr. L Ganesh, Chairman, Rane Group and Dr. V. Sumantran, Chairman, Celeries Technologies (Former CEO Tata Motors- Car Business), both icons in the automobile industry, proceeded to inaugurate the exhibition having over 70 stalls. Both were impressed by the conference and the exhibition.

Four **Panel Discussions** were organised during these three days.

The topic for first panel discussion was “Future of the Indian Die Casting Industry in the Global Scenario”, which was moderated by Mr. A. K. Taneja, MD & CEO, Shriram Pistons & Rings Ltd. The panellists were -

- S. Rajagopalan, CEO, Ashley Alteams India Ltd.
- S. Parthasarathy, Chief Executive Officer, Rane (Madras) Limited
- Dr. Aniruddha Karve, Managing Director, Molten Metal Systems, Morgan Advanced Materials Inc.

The topic for second panel discussion was “Shaping Your Business To Be Global” which was moderated by Dr. Aniruddha Karve, Managing Director, Molten Metal Systems, Morgan Advanced Materials Inc.

The panellists were -

- Christian Kleeberg, Executive Director, Foundry Resource Planning And Consulting Pvt. Ltd.
- Kumar Sinha, Kiran Udyog Pvt. Ltd.
- Kiran Deshpande, CEO & Director – Strategy, GTEC Aluminium
- Samuel Santhoshkumar , Managing Director Heracles Solutions, a Global IT Services

The topic for third panel discussion was “Technologies – Global Players Vision” which was moderated by Vivek Joshi, President & CEO, Sundaram Clayton Limited

The panellists were -

- Marc Fuchs, Global Director Of Sales (Die Casting), Buhler Druckguss AG
- Dr. Wolfram Stets, International Technology Manager Metal Treatment, Foseco Nederland BV
- Stuart Gregory, Managing Director, Petrofer UK Plc

The topic for fourth panel discussion was "Market Opportunities & Challenges" which was moderated by Mr. Deepak Mahajan

The panellists were -

- Dr. K. Manikandan, VP - Sourcing & Supply Chain, Ashok Leyland Ltd.
- Gopalkrishnan Shanker, President, Madras Consultancy Group
- Hrishikesh Kulkarni, Group Purchasing Director India, Valeo Lighting Systems India Pvt. Ltd.
- Shankhadeep Mukherjee, Senior Consultant, Cru Analysis & Consulting (India) Pvt. Ltd.
- M S Ravikumar, Country Leader - Integrated Supply Chain, Head of Manufacturing & Supply Chain, WABCO India Ltd.

(A detailed report of the Panel Discussions is attached for your reference)

Following **technical papers were** presented during this conference:

- **Electrochemically Neutral Blasting Operations For Aluminium Castings**
  Dr. Axel Schmitz , Export Director, Metalltechnik Schmidt GmbH & CO. KG

- **Innovative Process Cooling Solutions**
  Caleb Gilbert, Chief Marketing Officer, Frigel India

- **Influence Of Die Face Lubricants On Adhesive Qualities Of Structural Components In High Pressure Die-Casting**
  Stuart Gregory, Managing Director, Petrofer UK PLC

- **Premium Tool Steel Solutions For High-Class Cast Products**
  Markus Best, Key Account Manager, Kind & Co, Edelstahlwerk, GmbH & Co. KG

- **Shaping Uddeholm Dievar For Future**
  Richard Oliver, Hot Work Application Manager – Uddeholm AB

- **Acutrak® - Direct Electric Heat (DEH) System Well Suited For Aluminum Die Casting Operation**
  Ajit Chaturvedi, Sales Manager, Inductotherm (India) Pvt. Ltd.

- **Surface Preparation Through Innovative Blasting Techniques For Aluminium Components**
  Sharad Pandit, Head Sales – W&A (South And Govt. Projects), Disa India Limited

- **Optimization By Selection Of Innovative Material Handling, Coating Equipments & Automation For Aluminium Products.**
  Satish Pisal, General Manager – Sales, Intech Surface Coatings Pvt. Ltd.

- **Olympus Non-Destructive Testing Solutions for Casting Inspection**
  Mohd Arshad Uddin, Product Specialist-NDT, Olympus Medical Systems India Pvt. Ltd.

- **Solutions for Manufacturing Competitiveness" – Aluminum Components**
  Praful Shende, CSMO, Bharat Fritz Werner Ltd.

- **Computed Tomography (CT) As A Promising Technology For Industrial Quality Control And Inspection Of Castings**
  Nilesh M. Kawade, Director, Design Guru Engineering Services LLP

- **Microscopy Solutions For Casting Industry**
  Palaniappan Muthaiah, Manager - Product Application Sales Specialist (Pass), Industrail Quality Solutions, Carl Zeiss India (Bangalore) Pvt. Ltd.

- **ESI Procast For Virtual Die Castings**
  T. M. Manjunatha, Business Development Manager, ESI Software (I) Pvt. Ltd.

- **Additive Manufacturing for Gas Turbine Hot Gas Path Components**
  Dr. Dheepa Srinivasan, Chief Engineer, Pratt & Whitney, United Technologies Corp.

- **Simulation Driven Methoding With Inspirecast For Profitable Die Casting**
  Shibashis Ghosh, Technical Manager – Design & Manufacturing, Altair Engineering India Pvt. Ltd.

- **Analysis Of Additive Manufacturing Processes And Parameters By Three-Dimensional Computational Fluid Dynamics Simulation**
  Kaushik B, CEO, Kaushiks International

A Project Competition was conducted and selected foundries who were the contestants for this c**ompetition** presented their respective projects and this was well appreciated by all the attendees. The following projects were presented -

- **INSPIRON ENGINEERING PVT. LTD**
  Using Squeeze Pin To Eliminate Shrinkage In HPDC Product
- **POOJA CASTINGS PVT. LTD.**
  Innovation Project - GDC Tilting Machine
- **POOJA CASTINGS PVT. LTD.**
  Rejection Reduction - Intake Manifold 4PL CNG
- **ROOTS CAST PVT. LTD.**
  Process Optimization Project
- **ROOTS CAST PVT. LTD.**
  To reduction Blowholes in filter head

Dr. Karve presented trophies to the winners -

- Pooja Castings Pvt. Ltd.
- Roots Cast Pvt. Ltd.
- Inspiron Engineering Pvt. Ltd.

The final round of the Quiz Competition was an exciting experience for all present where the following winning teams from each zone participated -

- Ashley Alteams India Limited, Chennai
- Pooja Castings Pvt. Ltd., Pune
- Shriram Pistons & Rings Ltd., Bhiwadi
- Unique Shell Mould (India) Private Ltd. Coimbatore
- Raychem Rpg Pvt. Ltd., Ahmedabad

The grand winner was Unique Shell Mould (India) Private Ltd, Coimbatore Dr. Aniruddha Karve gave away the Trophies to the Grand winning team.

The **Best Casting Competition** saw the following companies bring their castings for display

- Alphacraft Pvt. Ltd.

- Aurangabad Electricals Limited, A CIE Automotive Group Of Company
- Growell Industries
- Pooja Castings Pvt. Ltd.
- Som Autotech Pvt. Ltd.
- Vulkan Technologies Pvt. Ltd.

Dr. Aniruddha Karve gave away the trophies to the winning teams -

- Pooja Castings Pvt. Ltd., Pune
- Alphacraft Pvt. Ltd.

The exhibition saw participation by 70 exhibitors. On the third day many exhibitors expressed satisfaction at the response and the business conducted during these three days.

We had the honour of having Mr. Satish Sangameshwaran, Managing Director, DAA Consulting Pvt. Ltd., as a Chief Guest of Valedictory function, who spoke on "Free Trade Agreements".

During the vote of thanks Dr. Aniruddha Karve thanked every one for the support and co-operation received all these years to make GDC TECH a strong forum.

Mr. Sanjay Mathur, VP Foundry India & ASEAN, FOSECO INDIA LTD., took over the charge of GDC TECH as Chairman for 2020-21 to 2021-22 and in his remarks he thanked for showing confidence in him. He expressed his commitment toward the growth of GDC TECH and assured to take this forum to a greater heights.

To conclude, Mr. R. T. Kulkarni, Vice Chairman, GDC TECH Forum thanked each and every participant for supporting this event and making it successful, while making a sincere appeal to continue supporting GDC TECH Forum.

MMTS 2019 International Conference & Exhibition Glimpses

Inauguration (Left to Right – L. Ganesh, Dr. Aniruddha Karve,

Release of Technical Volume (Left to Right – Aniruddha Inamdar, N. Kalyan, Dr. Aniruddha Karve, L. Ganesh Dr. V.

Project Competition 2019 Participants & Winners

Exhibition Glimpses

Inauguration of Exhibition

Exhibition

GDC TECH Chairman Dr. Aniruddha Karve Handing Over Exhibition Mementos to Exhibitiors.

Quiz Contestants Grand Final


Handing over the Flag to New Chairman


Arkey Team

Coffee Talk

COFFEE TALK 6th November 2019

Speaker
Kiran Deshpande

Subject
Value Stream Mapping leading to Innovations and unlocking Business Potentials

COFFEE TALK 11th December 2019

Speaker
Krishnakumar M Joshi

Subject
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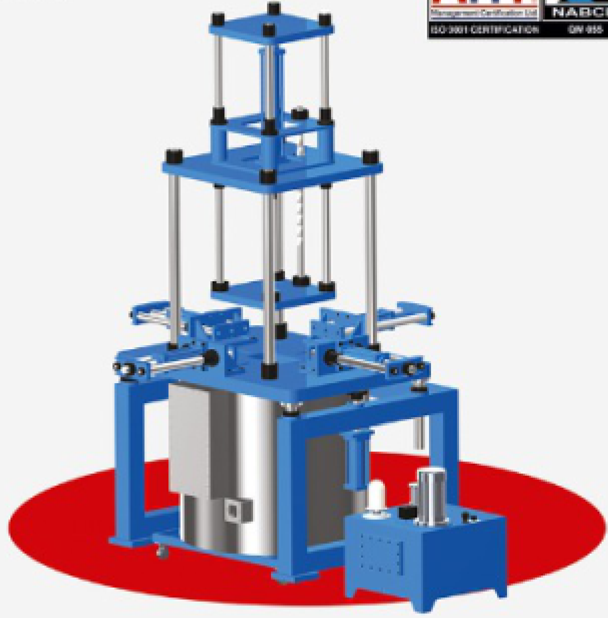

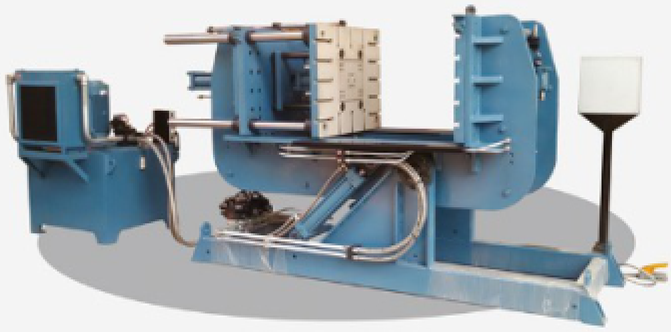

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