DIS Fall Meeting Wrap-up

Meeting attendees were treated to a tour of the Dotson Company in Mankato, Minnesota
We are pleased to announce that Tony Thoma has been appointed Vice President of the Ductile Iron Society (DIS). Tony, who is a member of the Society’s Board of Directors and Research Committee, accepted this position in October at the Fall DIS meeting held in Mankato Minnesota. Tony brings a wealth of business and governance knowledge as well as metallurgical expertise to his new position. He holds a B.Sc., Metallurgy and Materials degree from McMaster University, Bachelor of Business Administration degree from Brock University, MBA from the University of Western Ontario and he is a licensed professional engineer in the Province of Ontario.

Tony started his career as a Melt Supervisor at Stanton Pipes and then moved on to Norton Advanced Ceramics as a Process Engineer before moving to Wescast. Tony is currently Director of New Iron Development at Wescast Industries Inc., a Canadian corporation providing exhaust solutions for an extensive range of engines in the global automotive market. Wescast is the world’s leading supplier of cast iron exhaust manifolds for passenger cars and light trucks, and manufactures turbine housings, integrated turbo-manifolds and catalytic converter containers at several facilities on three continents. Tony joined Wescast in 1994 as Plant Metallurgist and soon took other career opportunities presented to him as he assumed many technical and leadership roles.

Tony is an active in many associations. He is a Trustee of the Iron Casting Research Institute (ICRI) and member of:

- the Board of Directors of The Association Major Power Consumers of Ontario (AMPCO);
- the Society Of Automotive Engineers (SAE);
- the Iron Castings Standards Division of the SAE;
- the American Foundrymen’s Society (AFS);
- the American Society for Metals (ASM);
- the American Society of Quality (ASQ); and
- volunteer member of the Board of Trustees for the Quality and Mission Committee at St Joseph’s Hospital in Hamilton, Ontario.

In his spare time Tony enjoys his hobbies of woodworking, photography, bicycling and scuba diving. He, his wife and three children live in Stoney Creek, Ontario.
Magnesium Recovery and Addition Rate in Tundish-Treated Ductile Iron

E. Jepsen
CWC Textron
Muskegon, MI

V. Popovski
Elkem Metals, Inc.
Pittsburgh, PA

ABSTRACT

The calculations that are associated with such alloy additions are based on knowing the beginning and goal levels of the element and the recovery rate of that element from the alloy. These calculations are straightforward; Goodrich\(^3\) described tin as having “been a popular alloy addition because it does not promote chill, is effective in stabilizing pearlite on the skin of the casting and has a predictable, 100% recovery.”

This is not the case with more volatile elements like magnesium (Mg). The recovery of Mg is far more problematic by the very nature of the element. In describing the magnesium, Klein\(^5\) wrote, “It has limited solubility in iron, and a boiling point of 2025\(^\circ\)F (1170\(^\circ\)C), far below normal iron treatment temperatures of 2700-2750\(^\circ\)F (1482-1510\(^\circ\)C).” This boiling and limited solubility cause a violent reaction that makes alloying iron with Mg a challenge.

The operating foundry recognizes that a certain amount of Mg-bearing alloy must be added to achieve the required level of nodularity in the final casting. For cost and metallurgical reasons the foundry seeks to minimize and control the amount of Mg alloy (in this case magnesium ferrosilicon, or MgFeSi) needed for production of ductile iron. The level of Mg in the final iron compared to the amount added in the form of MgFeSi is known as Mg recovery.

Knowing and controlling Mg recovery is a critical factor in effectively operating a ductile iron foundry. Karsay\(^4\) summarized in general terms what is in much of the literature when he wrote, “Recovery values vary with treatment batch size, master (treatment) alloy sizing, base iron chemical composition, treatment time, and with other influences.” Responsible operators are mindful of these variables and adjust the amount of treatment alloy accordingly.

However, by adjusting the amount of treatment alloy, another variable has been introduced not only to the final level of Mg in the casting but also to the recovery associated with the entire practice.

BACKGROUND

CWC Textron treats ductile iron in a tundish with MgFeSi. The tundish uses a pocket for holding the alloy and the pocket location was adjusted in January 2006. The addition rate of MgFeSi was periodically lowered as the foundry gained confidence in the improved practice.
Figure 1 reflects 1212 heats of ductile iron. The recovery formula was a straightforward one that accounts for variation in heat size and Mg content in the lot analysis of the treatment alloy:

\[
\text{Mg Recovery} = \frac{\text{actual residual Mg}}{\left(\% \text{ Mg in MgFeSi} \times \text{lbs MgFeSi}/\text{heat size}\right)}
\]

It is impossible to account for every other variable in the ductile iron process, but a few other facts should be noted:

- every heat was poured from the same 40-ton holding furnace
- every heat was of the same grade of ductile iron
- every heat was used to produce the same part
- tap temperature and base sulfur showed no appreciable impact on Mg recovery

The chart shows with a confidence interval of 55% that Mg recovery falls in relation with the amount of treatment alloy used. Therefore, one cannot assume that each marginal unit of MgFeSi alloy will perform as well as the one added before it.

![Figure 1: Graph of Magnesium Recovery MgFeSi Alloy Addition Rate](image)

CONCLUSION

The recovery of magnesium in tundish-treated ductile iron is subject to multiple influencing variables. One of these is MgFeSi alloy addition rate. Higher MgFeSi additions mean poorer overall Mg recovery.

At higher addition rates of MgFeSi it is hoped that all of the MgFeSi and cover material still fit in the pocket, but under these conditions it is also more likely that not all of the material actually fits in the pocket as is desired. As such, it is difficult to say if the recovery is inferior because more alloy was added while fitting, or whether the alloy actually spilled out to where it did not belong. It is therefore suggested that foundries need to keep the pocket clean so it retains enough volume for all of the MgFeSi and all the cover to fit into.
Even assuming the presence of a clean pocket and correct alloy addition practice, each marginal unit of MgFeSi is by definition closer to the liquid iron and will have less of the needed pocket protection for good Mg recovery. As such, each marginal unit will have inferior recovery than the whole and will drive down overall Mg recovery in the heat. In short, given that a certain amount of treatment alloy results in a certain level of residual magnesium, the operator cannot assume that a given additional amount of alloy will achieve a linearly corresponding final level of magnesium in the casting.

This means that the operating foundry person must consider how to react to a drop in Mg recovery during the course of production. The path of least resistance is to simply add more alloy because nobody can argue that the casting needs sufficient Mg to be nodular iron. However, the price to pay for this expediency has been exposed as severe in that the added units of MgFeSi are not nearly as efficient as the regularly added units. The correct response is to seek out and solve the cause of the inferior recovery and proceed with production at the prescribed operating levels.

REFERENCES

AFS Announces Metalcaster of the Year Winner

General Motors' Saginaw Metal Casting Operations, Saginaw, Mich., is the 2007 Metalcaster of the Year. The firm's newly installed precision sand casting process has made it one of only a few facilities with the technology. The Metalcaster of the Year award is presented annually to a North American metalcaster that has demonstrated engineering expertise to advance the capabilities of the industry. It is based on the recipient of the American Foundry Society's Plant Engineering Award.

Past winners include:

- Dotson Iron Castings, Mankato, Minn.
- John Deere Foundry, Waterloo, Iowa
- International Truck and Engine Corp.'s Waukesha Manufacturing Facility, Waukesha, Wis.
- Neenah Foundry Co., Neenah, Wis.
- American Cast Iron Pipe Co., Birmingham, Ala.
Mankato, MN – October 17-19, 2007

Meeting attendees were treated to a tour of the Dotson Company in Mankato, Minnesota

DOTSON PLANT TOUR

The second Technical and Operating meeting of the year was held on October 17-19, 2007 in Mankato, MN. The host foundry was Dotson Company located in Mankato. Thank-you to all the employees at Dotson for the time taken to organize a well planned tour. The personnel at the Alltel Center and the Hilton Garden Inn did a superb job of keeping things running well and comfortable for all the attendees.

If you missed this meeting, you missed a tour of a well organized foundry and 9 excellent presentations. Thank-you goes to Denny Dotson and his staff for assisting with all the arrangements.

Here are some facts about Dotson Foundry,

- Single location on 100,000 square feet of land
- Ductile/Gray iron jobbing shop
- 200 Active customer base
- ISO 9001 Certified
- 137 employees, 90 union, 47 support staff
- Pour 24 hours per day, 5-6 days per week
- 2-8000#, 1500 KW induction furnaces
- Sinto FBQ-35 with autopour, Hunter XL, Hunter 20C – all 20X24 flask
- 2 Laempe core machines – L10 and LB25
Shakeout via Didion rotary drum – degating via hydraulic wedge

Shotblast using 14 cubic foot SST drumblast and 14 cubic foot Wheelabrator

Inspection/BHN inline on conveyors

Grinding-40% done on 4 Barinder CNC grinders set along the inspection lines, the balance done by a subcontractor on traditional grinders.

At the meeting in Mankato there were 106 members and 11 guests in attendance.

Please watch the DIS Website for more information on our Spring 2008 Annual Meeting in Milwaukee, WI from June 18-20 with a tour of Kohler Industries.

James Wood
DIS Executive Director
Erin Chen from Mei Ta Industries Receives Membership Certificate from DIS President Joe Farrar

Additional Membership Certificates were issued to new members Donsco, Inc. in Wrightsville, PA and Sri Akila Castings in Guindy, Chennai, India

JED FALGREN

Jed Falgren of The Dotson Company gave a slide presentation on the Honor Program at Dotson. The Honor program presents Honor bookends to current and past military personnel to say "Thanks" for their service to our country. Over 500 have been given out so far. Click picture above to view PowerPoint Presentation.

If any foundry would like to get patterns to do this they should contact Denny Dotson at denny@dotson.com
MATT BERNDT
"Comparing ATAS with Different Base Irons"
No BIO available
No topic summary available

PREM MOHLA
"Project #42 Nodularity & Ultrasonic Velocity Measurement in DI"
with Rick Gundlach, Stork Climax
No picture available
No topic summary available

BIO
PREM OBTAINED HIS METALLURGICAL ENGINEERING DEGREE FROM THE INDIAN INSTITUTE OF TECHNOLOGY (ITT) IN BOMBAY, INDIA. HE THEN OBTAINED HIS PHD (DOCTORATE) FROM THE UNIVERSITY OF SHEFFIELD, ENGLAND. HE HAS OVER 40 YEARS OF INDUSTRIAL EXPERIENCE IN THE TECHNOLOGY OF GRAY & DUCTILE IRON CASTING PRODUCTION AND THE DEVELOPMENT AND MARKETING OF SPECIALIZED FOUNDRY ALLOYS. THE COMPANIES HE HAS WORKED FOR INCLUDE TATA (IN INDIA), FORD, INTERMET, GLOBE METALLURGICAL AND NOW HICKMAN, WILLIAMS & COMPANY. HE HAS SERVED ACTIVELY AS A MEMBER OF THE AFS, INSTITUTE OF BRITISH FOUNDRYMEN, INSTITUTE OF INDIAN FOUNDRYMEN, DIS AND FEF BOARDS. HE HAS VISITED SEVERAL FOUNDRIES AROUND THE GLOBE.
RICHARD GUNDLACH

No topic summary available

BIO

RICK IS THE SENIOR METALLURGICAL ENGINEER AT STORK CLIMAX RESEARCH SERVICES, A METALLURGICAL ENGINEERING AND TESTING LABORATORY LOCATED IN WIXOM, MI. CLIMAX RESEARCH SERVICES WAS CO-FOUNDED BY RICK IN 1987 AND WAS RECENTLY PURCHASED BY STORK SMT IN 2006. PRIOR TO THE FORMATION OF CRS, RICK WAS A METALLURGICAL ENGINEER AND RESEARCH SUPERVISOR FOR 18 YEARS AT CLIMAX MOLYBDENUM COMPANY (AMAX) IN ANN ARBOR, MI. RICK HOLDS HIS BS AND MS DEGREES IN METALLURGICAL ENGINEERING FROM THE UNIVERSITY OF MICHIGAN IN ANN ARBOR, MI. RICK IS WIDELY RECOGNIZED EXPERT IN THE FIELD OF CASTING METALLURGY. HE HAS AUTHORED & CO-AUTHORED MORE THAN 50 PAPERS PUBLISHED IN AFS TRANSACTIONS, METALLURGICAL TRANSACTIONS, METALS PROGRESS, INTERNATIONAL CAST METALS JOURNAL, CASTING ENGINEERING, AND VARIOUS CONFERENCE PROCEEDINGS. RICK IS A RECIPIENT OF THE AWARD OF SCIENTIFIC MERIT AND THE HOWARD F. TAYLOR AWARD BY AFS, AND 2 OF RICK’S PAPERS WON THE BEST PAPER AWARD IN THE GRAY IRON DIVISION OF AFS. HE HAS CO-AUTHORED A HANDBOOK ON ABRASION-RESISTANT WHITE IRONS, CHAPTERS IN 2 ASM HANDBOOKS ON CAST IRONS AND A CHAPTER IN THE AFS DUCTILE IRON HANDBOOK. RICK IS A MEMBER OF THE ASM AND AFS. HE ALSO IS A
ROSS VASS

"Cutting and Grinding Ductile Iron with Diamond Tools"

No topic summary available

BIO


Dennis Dotson(L) receiving speaker gift from Meeting Chair Gene Muratore

DENNIS DOTSON

"Critical Performance Systems"

No topic summary available

BIO


DENNIS HAS BEEN VERY ACTIVE IN THE INDUSTRY SINCE 1976 WHEN HE WAS A FOUNDING BOARD MEMBER OF THE METAL CASTERS OF MINNESOTA. HE

DENNIS HAS A STRONG COMMITMENT TO EDUCATION AND IS A TRUSTEE EMERITUS OF THE MINNESOTA STATE COLLEGES AND UNIVERSITIES, THE GOVERNING BOARD FOR THE 35 POST-SECONDARY STATE INSTITUTIONS. DENNIS AND HIS WIFE CAROLE, HAVE FOUR CHILDREN AND FIVE GRANDCHILDREN.
Dotson Iron Castings

becoming the world's most automated jobbing foundry
We are asking the foundry industry to join with us in thanking our veterans. So far we have given out 500 honor castings. The next goal is to say “Thanks” to 10,000 veterans. We need your help.
Honor Bookends Given to Employees

First shift employees Jim Ganzel, Orange Flowers, John Hatcher, Bruce Blank, Ron Mealman and Lyle Hoffman receive bookends to honor their military service.

Harley Goff search his house from attic to basement looking for this hat that he wore every day in Vietnam.
Honor Bookends for MN Heroes

Scott Schlueter and Blaine Johnson had a good idea several months ago. When three Minnesota service men were killed in action on the same day, Scott and Blane said that we should send Honor bookends to the families. The response from the families was very emotional and encouraged us to send bookends to the families of all Minnesota service people who had died serving our country in Iraq.

Finding the families and getting the plaque information for the 27 bookends is not an easy task. Amber Reichel and her mother Alane took up the challenge and have made hundreds of phone calls.

So far we have sent completed bookends to just over half of the families.
A Family Says Thanks

April 20, 2005

Dear Blaine & Scott,

Our family would like you to know how much we appreciated the book end that you made and sent to us in memory of our son, husband, & brother, SGT Jesse Lhotka. It is truly a work of art, with the insignias and the plaque with his name on. We have shown it around and everyone has been very impressed. We have been asked from several local businesses if they could put it on display for Memorial Day and believe we will let the Public Library do that and then be returned to our family.

It is also overwhelming that you would show such kindness and thoughtfulness to our family. We were particularly glad to be able to put a face with the kindness, thank you for the picture. This time in our life is very sad and it seems to hard to go on, but then someone like you does this and we realize how blessed we are and that both of you understand the turmoil of war and service life very well.

We are very proud of Jesse and will proudly display this bookend, passing it down through the generations. ( it definitely will with stand time!) Although Jesse did not have any children he left behind a wife, Stacie, mom, Bev, 1 brother Quinton 17, & 4 sisters, Molly 23, Vanessa 21, Sonja 18, & Amy 15. Again thank you for your kindness from all of our family.

Sincerely,
The Lhotka Family
Stacy, Molly, Vanessa, Sonja, Quinton, Amy.

P.S. If you are ever in Appleton, please look us up
131 W. Warring St.
320-289-2309
blhotka@econar.com
Thank you so much for the bookend we received in Guyan's honor. It will have a special place in our home along with the other momentos we have of Guyan.

Thank you for remembering the families of our fallen. Thank you, we truly appreciate it.

God bless you all! Efing'a Ophiya
Mr. Dotson,

I've been sitting here staring at this screen trying to come up with the words appropriate enough to thank a stranger for the ultimate kind deed he's done for a veteran of the Viet-Nam War. Thank you just doesn't seem to be enough. Talk about someone who's lost for words. This act has definitely touched me. You have to understand Mr. Dotson, this ex-Marine is one who had rotten eggs and tomatoes tossed at him when he came home...and this while I was on a stretcher. Talk about someone who's felt he's never come home from the war. My own family never once said "welcome home" or "thank you". Not "blowing my own horn"...but here's a guy who was awarded (4) purple hearts, (3) bronze stars with combat "V", the Viet-Nam cross of gallantry, and he hides them in a food locker up in the attic for 25 yrs., because he's led to believe it was all for nothing. 10 yrs ago my wife retrieved my medals dusted them off and had a frame made where by now they are hanging up above the fireplace. But to this day I'll still get somewhat of a "smirk" from people when they find out these awards were awarded during the Viet-Nam war. I was a Sniper with the 7th Marines.

Now here comes a "stranger" who makes me this exquisite piece, gives it to me, and asks nothing in return. And he even "thanks" me for serving my country. And all I can come up with is a humble thank you. But I can assure you it comes from deep within.

Thank You Again,

John Perry

Our Honor Bookend program is touching lives. After you read this, think about someone you know who was in Viet-Nam and deserves a "thank you" for serving our country. A bookend from you, even as a "stranger", will have a dramatic effect.
Chistoff Heisser (r) receiving his speaker award from Meeting Chair Kathy Hayrynen

BIO

Chistoff received his equivalent of a Masters Degree in Foundry Technology at the Technical University of Clausthal in Clausthal, Germany. After his first employment as Leader of Research and Development at Thyssen Feinguss, an aluminum investment casting foundry in Soest, Germany, he joined Magma GmbH in Aachen, Germany in a marketing and support position. Christoff moved to Magma Foundry Technologies, Inc's Chicago office in 1995 as Foundry Application Engineer. He now is the President of Magma Foundry Technologies, Inc.

____________________

“Autonomous Casting Process Optimization”

Christoff Heisser

The development of computer processing speed over the last decade is truly amazing. In 1995, when we started measuring simulation speed to give customers hardware recommendations, an average casting process simulation (filling and solidification) took more than 2 days. This was on high performance workstations at a price point of US$150,000.00 and above. Today, a basic PC for less than US$3,000.00 can perform the very same simulation in less than one hour. Spend twice that much, investing in a “quad-core” PC, and it will be done in less than half an hour. How long would it take if someone would invest the same US$150,000.00 into a 32 core Cluster? Less than 3 minutes - more than 1000 times faster than in 1995!

What implications does this have on the use of Casting Process Simulation? First and foremost, it is much more usable as it provides answers much faster. Secondly, it is affordable even for small foundry operations as the return of investment is achieved much sooner. But it also leads to a paradigm shift. Traditional Casting Process Simulation is based on “What-If” scenarios, demanding a user to make a decision, implement changes, and start another “run.” The user used to wait for the completion of a simulation or ran it over night to check on it the next morning. Today, if the operator starts a simulation just before he leaves for home, the computer might finish the simulation in less than one hour and sits idle for the next 14 hours! One way around this would be to have the engineer set up ten different designs (i.e. ten different risers, gate configurations, pouring temperatures, etc.) and queue them up. Lot’s of work in setup, and at the end he has to review all simulations and pick the best one – the best one of the ten, not the optimal one! The solution to this dilemma is to combine the Casting Process Simulation tool with an Autonomous Optimization Tool. The later are used for many years in the design community to optimize designs. MAGMAfrontier is an add-on module to the MAGMASOFT suite of application modules. It can be added to the existing software and thereby allows the user to utilize...
autonomous optimization.

How does it work? Instead of setting up i.e. ten separate simulations of ten riser designs, the user defines a parametric riser geometry and defines, i.e., upper and lower limits of its radius or several radii over its height, upper and lower limits of it's height and where to locate it. One could as well define riser neck dimension limits and location. After defining the objectives of producing a defect free casting and minimize riser volume the optimization can be started. A genetic optimization code assures the meaningful combination of parameters and target oriented modifications leading to the optimum result – sort of like children having the best of each parent combined in them. At the end, the optimization will depict the optimal riser, leading to a defect free casting with the smallest riser volume – the only result the user has to review. The result evaluation will provide the user with information on how the design developed and why the depicted best design is the best design.

One setup – multiple autonomous simulations – one optimum result.

Autonomous Casting Process Optimization minimizes the time needed for the operator to spending time on input and evaluation and, at the same time, maximizes the utilization of the hardware. The key to this technology is the easy setup, the multi-objective optimization (just what a foundry engineer has to do every day), and straight forward result evaluation pinpointing the optimal result. MAGMAfrontier can be used to optimize almost any parameter that is considered in state-of-the-art casting process simulation: Casting-, riser-, gating-geometries, process parameters, mechanical properties, residual stresses and hot tears, etc.

In a challenging environment of ever higher demands on casting quality, delivery time, costs, and scars qualified human resources Autonomous Casting Process Optimization is an enviable tool to conquer these challenges and best use the available engineering capacity, retain qualified people and attract the next generation of foundry engineers.

Development of Casting Process Simulation speed over the last decade.
Principle of Autonomous Casting Process Simulation tool MAGMAfrontier

Gating Optimization Example
Tony Midea (L) receiving his speaker award from Meeting Chair Gene Muratore

BIO

Tony graduated with his Bachelor of Science in Aeronautical Engineering from The Ohio State University and his Masters of Science in Aeronautical and Astronautical Engineering from the University of Illinois. Tony started his working career with McDonald Douglas as Propulsion Systems Performance Manager for the F15E product line and Senior Engineer for the F-18, AV8B and T45 Projects, as well as several "black" projects. He also worked six years with NASA doing propulsion system integration for the high speed civil transport and the two-stage-to-orbit vehicles. Tony has been with Foseco Metallurgical for 12 years using computer simulation to develop feeding system material thermal data, optimize products and to assist foundries with product applications and computer simulations. Currently, Tony is the Product Development/ Technical Group Manager. Tony is the past Chairman of AFS Engineering Division Executive Committee 1A and 1B. He is also the Past Chairman of the AFS Process Modeling Committee 1F. Tony has written over 38 technical papers for various organizations.

Analyzing Filter Flow Characteristics

Anthony Midea

AFS Engineering Division (1A/B) Past Chairman

FOSECO Metallurgical Inc.

Cleveland, Ohio

Introduction/Background

Molten metal does not magically appear within a casting cavity, but rather it is poured through a conventionally designed system consisting of a sprue, runner bars and ingates, or through a direct pouring system. Oftentimes, the difference between good castings and scrap is partly determined by the quality and consistency of the method by which the casting cavity is filled.

Quality of the metal flow means minimizing inclusion generation, and consistency means delivering molten metal to the casting cavity in the same orderly fashion, every time. Engineers employ the Laws of Continuity and Mass Conservation to help them design good quality gating systems, and Computational Fluid Dynamic (CFD) programs are often used to evaluate and improve the design.
No matter how good the design of the metal delivery system is, inclusions already present in the molten metal may find their way into the casting cavity. These types of inclusions must be mechanically removed from the metal stream. In addition, momentum caused by gravity acting upon the molten metal can be difficult to dampen, and this can result in metal damaging flow turbulence and oxide inclusions. In many instances, these problems are difficult to solve with delivery system design alone.

A common way to address these challenges is to use filtration devices to help trap inclusions and modify the flow stream. It is easy to visualize how various filter structures can physically trap inclusions, but it is less obvious to visualize how they alter the metal flow itself. But there is a straightforward explanation.

The metal flow stream sees a filtration device as a flow discontinuity, which means that the Law of Continuity does not apply across filtration devices. The filter acts as an obstacle to the free flowing metal, and this results in a reduction of flow momentum and velocity, much like a resistor in an electrical wire reduces the voltage. In both cases, the discontinuity is designed to reduce and control the energy and flow of the medium.

Historically, it has been difficult to analyze the detailed flow characteristics of individual filtration devices. X-ray and water flow devices have typically been used, but there are severe limitations to the ability to draw quantitative results from these types of experiments. Computational fluid dynamic codes have also been employed to varying degrees with some success\textsuperscript{1-5}, but these studies can be extraordinarily time intensive to conduct.

This paper documents the results from a new study that analyzes, using CFD, the flow through different filtration devices, and compares these results to an identical gating system without a filter. The overall effect of the filter on the metal flow of the system is analyzed, as well as the flow characteristics just before and after the filter itself.

### Summary/Conclusions

This study analyzes, using CFD, the flow through different filtration devices, and compares these results to an identical gating system without a filter. Pressed, cellular extruded and foam filtration devices were analyzed, in particular.

The results show that any of these three filtration methods is successful in modifying the metal flow in such a way that the metal velocity and flow energy are reduced, as compared to not using a filtration system at all. Foam filters, which are naturally more restrictive than either extruded and/or pressed filters, are able to more significantly reduce the flow velocity, energy and turbulence, and result in the best runner bar flow characteristics of the filters tested in this study. The extruded and pressed filters yielded similar results, except inside the filter itself and very near the filter exit. Inside the filter, the pressed filter had higher velocities within its channels as compared to the extruded filter, thus potentially reducing its ability to successfully mechanically trap inclusions. At the exit, the pressed filter exhibited a tendency to create flow jets, whereas the extruded filter did not, except for a row or two of channels at the bottom of the filter.
FEAS Announces Metalcaster of the Year Winner

Fall Meeting Presentation Summaries
- DIS Fall Meeting Wrap-Up
- Dotson Plant Tour
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- Analyzing Filter Flow Characteristics
- How Do We Become Metal Casting Missionaries - The story of FEF Foundry in a Box Project
- The Lean Paradox
- Semi-automated Core Line for Vertically & Horizontally Split No-Bake Core Boxes

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BIO

TOM IS A GRADUATE OF KENT STATE UNIVERSITY IN OHIO AND HOLDS A BACHELOR OF SCIENCE DEGREE IN INDUSTRIAL ARTS EDUCATION. AFTER GRADUATION TOM JOINED FOSECO AND WORKED IN PRODUCT DEVELOPMENT FOR 10 YEARS. HE THEN MOVED ON TO FOUNDRY HIS OWN COMPANY, WESCRAFT, SPECIALIZING IN THE DEVELOPMENT OF SAND BINDER SYSTEMS, COATINGS, ADHESIVES AND RELEASE AGENTS. THIS PERIOD OF SELF EMPLOYMENT LASTED FOR 15 YEARS. IN 1994 TOM WAS GIVEN THE OPPORTUNITY TO DESIGN, BUILD AND OPERATE A TEACHING FOUNDRY IN CLEVELAND. FROM 1997 TO 2000 TOM WAS RESPONSIBLE FOR QUALITY AND ENGINEERING AT CASTALLOY, A CLEVELAND COMMERCIAL INVESTMENT CASTING FOUNDRY. TOM IS NOW THE R&D MANAGER FOR OMNISOURCE. TOME HOLDS 2 US PATENTS AND 2 EUROPEAN PATENTS. TOM ALSO HAS OVER 20 YEARS OF TEACHING EXPERIENCE AT THE HIGH SCHOOL & COLLEGE LEVELS. HE IS ALSO A FEF STUDENT FROM KENT UNIVERSITY. TOM IS THE CHAIRMAN OF THE EDUCATION COMMITTEE FOR THE EDUCATIONAL FOUNDATION, FORMER CHAIRMAN OF THE NEO CHAPTER OF THE AFS, AND NATIONAL AMATEUR WINE COMPETITION CHAIRMAN FOR THE AMERICAN WINE SOCIETY. TOM & HIS WIFE JAN, RESIDE IN STRONGSVILLE, OHIO, WHERE THEY MAKE AWARD WINNING WINES, AND FOLLOW THE CLEVELAND BROWNS IN THEIR SPARE TIME.

How do we become Metal Casting Missionaries?

The story of the FEF Foundry in a Box Project

By Tom Cobett
FEF Education Committee Chairman
R&D Manager - OmniSource Corporation

FEF strengthens the Metal Casting industry by supporting unique partnerships among students, educators and industry, helping today's students become tomorrow's leaders.

After WWII ended, there was a desperate need for skilled technicians and educated leaders in the U.S. Metal Casting industry. The Foundry Educational Foundation (FEF) was established in 1947 by the leaders of the Metal Casting industry, with the support of affiliated organizations and societies, as an independent method of promoting Metal
Casting educational programs at colleges and universities across the country. The primary goal was to bring top-quality men and women into our industry. FEF has since become the Lifeline of quality people to the Metal Casting industry throughout all of North America.

FEF continues to supply the industry with enthusiastic, technical and management-oriented people. Over 70% of all FEF scholarship recipients have reported full-time employment in Metal Casting as their first job after graduation. Industry and government sponsored research at FEF schools has become the core of important developments in the Metal Casting industry. Indeed, most of the significant Metal Casting technology transfers since WWII were likely to have been accomplished by FEF graduates.

Another of the goals of the FEF has been, “To strengthen the image of FEF among educational institutions, government, professional societies, customers and supporters.” In an effort to fulfill this lofty goal, FEF has been considering ways to get Metal Casting presented to students as early as possible during their formal education. Since most young people, and probably most older people, have no clear idea what Metal Casting is, we thought that it would be a good idea to develop a very simple, safe and clean method of demonstrating the Molding, Melting, Pouring and Finishing of a small casting.

Three young women at Tri-State University in Angola, IN, decided to take on the challenge of developing such an educational unit as their Senior Project in 2005. Brianna Clemens, Stephanie Vogelpohl and Project Manager Sarah Weigle worked closely with their University Advisor, Dr. Forrest Flocker, and their Industrial Advisor, Tom Cobett, of OmniSource Corporation. Their project was well received by their peers, their professors and the industry. The prototype unit was immediately adapted for use at the ASM International Materials Camps.

An important side note to this story is that all three of these young women entered different facets of the Metal Casting industry upon graduation from Tri-State!

A team of students at Kent State University, under the leadership of FEF Key Professor Mike Dragomier, took up the challenge to improve the original concept by condensing everything into easily portable shipping boxes. The AFS Student Chapter at Kent State continues to manufacture many of the components of the Foundry in a Box, including the molding sand, flasks and matchplate patterns. Kent State and FEF alumni Trent True (Harrison Steel Castings, Attica, IN) and Ben Hunsicker (OmniSource, Ft. Wayne, IN) have been instrumental in further down-sizing the Foundry in a Box into just one box full of materials and equipment that can be used anywhere by nearly anyone.

The FEF Foundry in a Box allows students and teachers to utilize a non-toxic, oil-based molding sand to make a small matchplate mold. The K-BOND molding sand was largely developed by another FEF Alumnus, Jolene Miller Morello, at Kent State University, to replace smoke-generating, foul-smelling and toxic molding sands that contained standard motor oil. The K-BOND sand molds for the Foundry in a Box have no smoke, no odor and no toxicity.

The first few matchplate patterns we made had a simple FEF, AFS, ASM or CFA logo on them. Frankly, the kids weren’t too excited about having a casting with a few letters on it. We have since developed matchplate patterns with replica Indian arrowheads and small starfish on them. Now we have students standing in line to make a Tin casting!

The metal for the casting is pure Tin. This was chosen because of its low melting point (about 450°F), because of its lack of any toxicity and because it has a silvery luster as a casting. The melting is actually achieved in a modified microwave oven. Using molecular nano-heating technology, developed by some of the country’s leading
ceramic researchers, a specially designed susceptor crucible attracts the microwaves, rapidly heats up, and then melts the Tin metal inside of the crucible. Once the crucible is hot, it behaves the same as a crock pot. Anything that you put into it will get hot.

The microwave appliance we use starts out as a standard kitchen unit. Additional cooling of the magnetron and electronic circuits is accomplished by incorporating a recirculating liquid cooling system. The standard rotating glass plate is replaced with a piece of high temperature refractory board. Foundry in a Box team member, Ben Hunsicker, makes all of these necessary improvements in his home workshop.

In its simplest form of All-in-one-Box, the Foundry in a Box can be purchased from the FEF for a bargain price of $1500.00. This allows for the demonstration of melting Tin in a microwave oven and pouring it into a sand mold made from a matchplate pattern.

Other configurations of the Foundry in a Box Include:

- **Basic Set of two Boxes** - (Resistance Electric Melting, Sand and Permanent Mold) - allows for the demonstration of melting Tin in a resistance electric furnace and pouring it into a sand mold or a graphite permanent mold  
  **$3750 per set of two boxes**

- **Microwave Melting Box** - (with 2 MicroMelter crucibles, tongs, refractory plate and liquid cooling)  
  **$1250 per box**

- **Group Sand Molding Experience Box** - (12 Flasks and Matchplate Patterns)  
  **$1000 per box**

In the past year, volunteers including FEF Key Professors and board members have utilized the Foundry in a Box at events including ASM International “Materials Camps” for interested high school students and “Teacher’s Camps” for teachers interested in offering more Materials Science experiences to their students. We have also done presentations for American Foundry Society, Canadian Foundry Association and other technical association chapter meetings. Some individual High Schools have asked us to come and spend a day with their students. AFS and CFA Chapters have actually purchased a Foundry in a Box unit for use in their local area schools. We have even toyed with the idea of demonstrating Metal Casting at the mall on a Saturday afternoon!

Nearly all of the students that have seen the microwave melting have remarked that, “You shouldn’t put metal into a microwave oven!” When questioned about who told them not to put metal into a microwave, the majority of the students indicated that the directive came from their mother. On one occasion, we asked a young girl if her mother was a Metallurgist and she emphatically replied. “Yes, my mother IS a Metallurgist!” That night, we are sure that the young girl went home to teach her mother something new about melting metal with microwave energy.

How will we know if we have been successful with the Foundry in a Box Project?
One thing we know for sure is that if we do not educate our young people on the importance of the Metal Casting industry, then, there will certainly be fewer of them choosing Metal Casting as the place for them to start a career. There will certainly be more people who do not want Metal Casting plants in their communities. There will certainly be more government leaders saying that Metal Casting is a dirty and dying industry.

It's a bit like doing missionary work for your church. Does all of the missionary effort, done on behalf of our churches, do any good? It certainly doesn't hurt. With some luck, it may just enhance the quality of many people's lives.

For many of us in the Metal Casting industry, we can cite the name of one or two older people who directly influenced us in our choice for a career. They helped us at a critical time in our lives and now it is time for us to help other young people. Somebody has to pick up the challenge to be a Metal Casting Missionary. We hope that the FEF Foundry in a Box equipment will help these industrial missionaries be successful in their quest, and allow them to have some fun along the way.

If all we accomplish is to enlighten a few young kids about how foundries are important to our economy and to show them that making castings does not have to be hot, dirty and dangerous, we will have been extremely successful.

For further information on the Foundry in a Box equipment, or to volunteer some of your time for the project, contact the FEF Executive Director Bill Sorensen at bill@fefoffice.org or FEF Education Committee Chairman Tom Cobett at tcobett@omnisource.com.
From: Minnesota Technology Magazine - Spring 2007

Bio

Mary Connor, MTI

Mary Connor has over 32 years of manufacturing, financial management, marketing and consulting experience that includes strategic planning and computer OEM marketing to the U.S. Department of Defense. She began her career as a Proposal Manager at Unisys; has been the Controller for the College of St. Catherine; was the Chief Financial Officer, owner and secession consultant of Midwest Fire Protection; and is currently a Business Specialist with Minnesota Technology, Inc.

Ms. Connor holds a Bachelor of Science degree in Business Administration and Business Education from the University of Minnesota as well as a Master of Business Administration from the Carlson School of Management, University of Minnesota. In addition, she is certified by Ewing Marion Kauffman Foundation as a Fast Trac for Manufacturing Trainer. She has also received training in Lean culture, innovation, industrial marketing, Value and Strategic Pricing and ISO 9001:2001 Transition

The Lean Paradox

How can a growth specialist endorse the principles of Lean? After all, isn’t bigger better? The more the merrier?

Lean is a paradox: To grow, one needs to shed useless processes. To succeed, a culture of discipline needs to be established; yet it is a discipline that calls for flexibility and adaptability. To improve, constant changes are implemented—but how can you regularly make changes without creating chaos? How can the answer be to ask more questions?

The seeming contradictions in Lean are something I get asked about regularly when I consult with businesses that don’t know exactly how the principles are supposed to work. I first explain how eliminating or streamlining processes allows for growth. By eliminating the waste of inefficient procedures, an organization can rapidly add capacity. This frees up cash that could be frozen in inventory - and capacity and cash are both needed for growth. Other growth benefits of Lean are realized when an organization can secure new business from existing or new customers because of newly developed competitive strengths such as shorter lead times, lower cost, and better quality.

For those concerned about how a company can continually improve while retaining some stability in the organization, I respond by talking about Lean culture. Culture is a set of shared beliefs, customs, and practices carried out by a group of people. By following a cultural structure, people identify with the goals of their group as well as further them. It’s true in a business culture, too. An organization should develop cultural structures that promote accountability, compel the right behavior, and remove
opportunities for error. By standardizing business processes in this way, grey zones for decision-making are eliminated. Organizations where Lean culture has been fully embraced can begin to extend beyond the organization to grow with other Lean external partners in the supply chain.

Structure is a good thing, especially for those who are overwhelmed by the crises of day-to-day operations. For Lean initiatives to take root, it is essential to stabilize things in the organization before making massive changes. An organization with excess inventory, overtime, and expediting usually has unstable processes and an insecure workforce. Focus first on stabilizing.

Lean has several tools with which to create structure, such as Flow and Visual Workplace, which help to quickly expose problems. Exposing and solving problems are at the heart of the Lean system. Once identified, issues can be addressed and corrective action taken. The simplified model: Standardize the work, find problems, fix them, standardize the fix so the problems don’t recur, repeat.

When first introduced to Lean, I find that it is a common misperception for businesses to think it’s all about learning these sorts of techniques and tools. But in actuality, tools such as kan-bans are often temporary responses until a better solution is found or conditions change. To achieve the ideal of continuous improvement, employee involvement at all levels of the organization is necessary. Understanding critical Lean tools and strengthening problem-solving skills is essential.

The Lean model is grounded in questions. We don’t tell, we ask; we don’t command, we engage. The Socratic style of iterative questioning helps employees reflect on the clarity and completeness of their ideas for improvement. In a true Lean environment, all assumptions are confronted with questions. Can we reduce or eliminate waste? Can we keep the material flowing? How does this activity benefit the customer? By relentlessly challenging processes, we continually find ideas for improvement. In a Lean environment, the notion of the ideal aims for zero defects, on-time delivery, a batch size of one, and a safe working environment. Seeking the ideal can be a major source of the creative tension that fuels further improvements. In this way, the answer really is to ask more questions.

Though it may seem confounding at first, Lean is elegant in its simplicity. But simple does not mean easy. If you settle, you send a message that good enough is good enough—which is the only truly contradictory notion when it comes to Lean.

Mary Connor MTI
Growth Management Consultant
David Knapp (L) receiving his speaker award from Meeting Chair Kathy Hayrynen

Bio

David is a 1959 Graduate Mechanical Engineer from Lehigh University and has a lifelong career in the foundry Industry. After military service in the U.S. Army Ordinance Corps, David joined Blaw-Knox Foundry and Mill Machinery in Pittsburgh as a Management Trainee. David moved on to Corapolis Steel Foundry and then transferred to Union Steel Works where he served as Foundry Manager making armored tank turrets. His first iron foundry experience was at the Beloit Corporation as Manager of Industrial Engineering, Safety Director and Foundry Superintendent. In 1969 he was VP of Operations for Teledyne OhioCast, which produced centrifugal tubes and heat resistant alloys. Subsequently he served thirteen years as VP at Elyria Foundry then joined Cast-Fab as Technical Sales Manager in 1992. At General Castings in Delaware, Ohio, David served as VP. In 2003, David joined Glidewell Specialties Foundry located in Calera, Alabama and travels extensively in the U.S. and Canada serving Glidewell accounts and developing new business. With some forty five years in the industry, David also provides technical support to the foundry on manufacturing, capital projects and business strategies. David and his wife Estelle life in New Albany, Ohio.

Semi-automated Core Line for Vertically & Horizontally Split No bake Core Boxes

Ductile Iron Society, Mankato, MN , October 18, 2007

David J. Knapp

Glidewell Foundry is a gray and ductile iron jobbing foundry located in Calera, Alabama. In January 2007 the foundry started up a new mechanized core line capable of running medium size horizontal core boxes together with two-piece core boxes that are vertically split.

A large part of Glidewell’s casting products are specialty valve bodies ranging from 12 inch diameters to 120 inches. Most of the volume, however, is in the 12 to 24 inch range. And until the line was developed, the basic practice of making medium valve cores in one piece was for the coremaker to fill boxes at floor level under an 800 lb/minute continuous mixer. There were few conveyors in the original operation, so the process was very labor intensive, using overhead cranes to lay down and strip each box and re-assemble. The decision to improve the operation began some 18 months earlier. Time studies showed that the majority of the cycle time to make a 12 to 24 inch valve was in box handling and cure time. The actual fill and ram times were only 12 to 17% of the cycle.
In a typical case of making 20 valve cores per 10 hour shift (with only one box), the coremaker had little time for anything else. One can imagine this as absolute drudgery. Only when the core was curing could the operator find a few minutes for other tasks, which were limited to just making small bench cores. (Note: there was little occasion to try and run two valve core boxes as there was no storage, space was limited, and cores were made to satisfy the molding schedule.)

**Key findings in Time study of Original Floor Coremaking**

<table>
<thead>
<tr>
<th>Operation</th>
<th>16&quot; Core minutes</th>
<th>Pct</th>
<th>24&quot; Core minutes</th>
<th>Pct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fill and Ram Valve core box</td>
<td>4</td>
<td>17%</td>
<td>8</td>
<td>12%</td>
</tr>
<tr>
<td>Handle box – set up; break apart, core strip, re-assemble</td>
<td>8</td>
<td>33%</td>
<td>16</td>
<td>26%</td>
</tr>
<tr>
<td>Wait for Valve core to cure</td>
<td>12</td>
<td>50%</td>
<td>40</td>
<td>62%</td>
</tr>
<tr>
<td>Total Cycle</td>
<td>24 min</td>
<td>100%</td>
<td>64 min</td>
<td>100%</td>
</tr>
</tbody>
</table>

As an alternative process to box filling with no bake mixer, investigation was also made into incorporating a large core blower, but here again the major issue was still material handling.

After time studies, the core room flow was charted and separated into the various types and sizes of cores. Several layout arrangements were presented until there was full agreement among the project team members.

Cores less than 100 lb were considered bench cores and would be made under a new 75 lb mixer. Cores to 1000 lbs with an envelope of 53L X 39W X 46H would be the limit for vertically split boxes and horizontal cores 60L X 40W X 24H would be the limit for rollover and dump boxes. Larger cores were to be continued to be made in the main bay under a large mixer.

After a number of meetings over most of a year, the final design evolved with some unique features. The last layout included a scale model of the proposed operation.

The entire system was to be powered conveyor with PLC's and sensors that would allow boxes to advance to subsequent operations automatically or with the push of a button. The fill station consisted of powered conveyor with compaction table mounted on a scissor table that sat in a pit beneath floor plates. In this way tall boxes could be lowered...
to a convenient height for the coremaker to fill and ram.

From the fill station control panel the coremaker could select a destination for the filled core box. This was either to a nearby station where a horizontal core boxes would await stripping or rollover. The other button selection was to send vertical split boxes (valve cores) around a loop to a tilt table. This station allowed the box to be laid on its side so it too could later be stripped.

While one coremaker was filling box after box from an advancing staging line, another coremaker would remove previously cured cores with the use of a mold handler and hoist mounted above the strip station.

Once cores were removed they were placed on 40 X 40 plywood sheets and sent to a nearby core finish station by use of a powered transfer car. Empty boxes needed to be re-filled were programmed to return by the same transfer car by pushing a button on a control panel.

Green cores were powered away onto selected gravity conveyor lines where they were finished and flow coated using a separate monorail hoist. Once washed and dried, the cores were pushed by hand on conveyor to a pickup station. Here a fork truck would put the cores on vertical storage racks to await the next day’s heat.

SUMMARY: The new core line dramatically changed the manufacture of medium cores at Glidewell and both simplified flow, reduced manual labor, and doubled output. Palmer Mfg & Supply Company of Springfield, Ohio engineered and furnished the equipment. And the system was installed during the last two weeks of December 2006. Since several shop people and maintenance people had a chance to see the line assembled in Ohio prior to arrival at Glidewell, startup went much better than expected. Of course there was a learning curve, and that was left mainly to the operators. This project represents the first step in automation at Glidewell and it is meant to free production people to focus on the products rather than be consumed by material handling.

David J. Knapp
Regional Sales Manager
Glidewell Specialties Foundry Co.
MEETINGS - BUSINESS - PEOPLE

MEETINGS

The **2008 Spring Meeting** of the Ductile Iron Society T&O Meeting will be held in Milwaukee, Wisconsin with a tour of Kohler Co. in Kohler, Wisconsin. Dates are June 18-20, 2008

The **Keith Millis Symposium** will be held at the Orleans Hotel and Casino in Las Vegas, Nevada, October 20-22, 2008. The meeting will feature a full technical program.

BUSINESS

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