



SFSA CASTEEL REPORTER

Steel Founders' Society of America

a publication serving
SFSA steel casting industry Members

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Casteel Commentary

This month's Casteel commentary advocates our industry making clean plants a priority. Instead of seeing this as a burden, we need to recognize this as an opportunity to improve our quality and profitability. As always, your comments and disagreements are welcome.

National T&O Conference

Make your plans now to attend the 2018 T&O Conference in Chicago on December 6-9. This year's conference will feature a range of typical technical and operating papers along with a special session on gating and pouring. Additional details for registration will be sent to members soon.

Duplex Stainless Steel and Future Leaders Meetings

Last chance to attend either the SFSA Duplex Stainless Steel (DSS) and Future Leaders (FL) group meetings. The DSS subject-focused meeting on Thursday (9/21) afternoon will include presentations on ferrite measurement and DSS research. The Future Leaders will meet Wednesday (9/20) morning for group roundtable and then partake in a seminar that will begin that afternoon through Thursday (9/21) morning on the development of DSS through the years to provide a fundamental understanding of the alloys. Attendees will have the opportunity to tour Omaha Steel on the Friday (9/22) morning. To RSVP, please contact David Poweleit at poweleit@sfsa.org.

Silica Compliance Guidance Documents for SFSA Members

Guimond and Associates have been working closely with the SFSA silica subcommittee and staff to draft a document on the development of a silica engineering controls program along with a series of guidance documents for members to assist them to control silica exposure for every area of the foundry that is a known source of respirable silica. Known source areas have been identified based on sampling data collected from industry. The documents will identify the source of exposure, control measures, and design recommendations based on best practices. The goal is to cover 90% of the equipment used in steel foundries. For example, rather than a basic document for shakeout, we will have several that will address specific types of shakeout – rotary, vibratory conveyor, etc. The initial set of documents will be completed and available to members by year end. Please contact Ryan Moore for more information at rmoore@sfsa.org.

Steel Casting Technology Course

Thanks to the support from Tom Stevens, the first Steel Casting Technology Course was a fantastic success! SFSA is planning to offer the course again in 2018. To reduce travel cost and time, the course will be offered over three sessions, which will be held in January, February and March. Attendance will be limited to the first 20 registrants. Please contact Diana David for more information at ddavid@sfsa.org.

Digital Innovative Design (DID) for Reliable Casting Performance

SFSA's "Digital Innovative Design (DID) for Reliable Casting Performance" program is creating a material property database to allow designers to select alloys as cast grades with confidence. We need your heat data, which will be kept with anonymity. Please contact Diana David for more information at ddavid@sfsa.org.

2018 Benchmarking Tours

SFSA is in the process of planning two opportunities in 2018 for members to visit steel foundries in Mexico and Spain. The Mexico visit will include tours of Fundidora Morelia, POK and Fimex as is scheduled for the week of February 5th. The Spain visit is being planned with AIST as was done in 2016 for a UK tour, and is tentatively scheduled for late June.

Research Reports

All of the SFSA Research Reports are available on the steel castings wiki. Recently, the following new reports have been added for the benefit of members:

- 117 - Simulation of Dimensional Changes and Hot Tears During Solidification of Steel Castings
- 118 - Simulation of Distortion and Residual Stress Development During Heat Treatment of Steel Castings
- A-99 - Optimization of Heat Treatments on Stainless Steel Castings for Improved Corrosion Resistance and Mechanical Properties
- A-101 - Phase Transformations in Cast Highly Alloyed Stainless Steels

Market News

Demand and production of steel and stainless steel castings has improved markedly, especially when compared to the depressed levels of the first half of 2016. While the improvement is welcome, the industry is still down significantly from the peak levels last seen in 2014 and before.

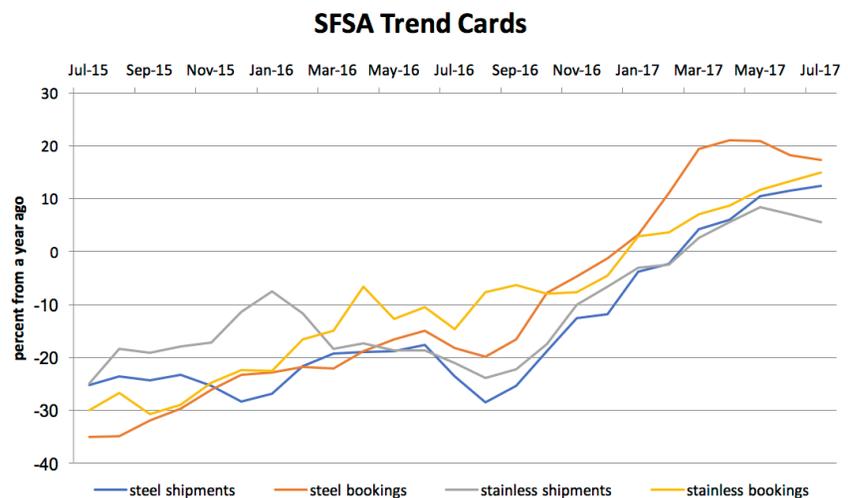
Bookings are well over 10% compared to a year earlier for both steel and stainless. The three month average exceeds the 12 month average indicating growth in the market.

Backlogs have risen from 6 weeks to over 8 weeks for steel and stainless production.

Steel mill production had an earlier increase but is similar now to the results in castings. Steel production reported weekly showed a softening for the first half of the year but since June has shown a nice increase. Prices for cold rolled steel has remained stable at over \$600 a ton for the year so far.

Of some concern, capital goods remain stagnant without any clear growth pattern through June. Oil prices have remained between \$45 and 50 a barrel stabilizing the market but not creating much incentive for investment. Improvements in drilling has led to increased demand for rail and oil field products. Copper prices have advanced and are currently over \$2.90 a pound.

This suggests cautious optimism for the balance of the year.



Casteel Commentary

Clean, not a word most people associate with steel foundries and yet....

As an industry, we need to be known as a smart, clean and friendly business. Smart means thoughtful in all our practices but also clever in our adoption and exploitation of information technology. We need more sensors, better data, and smarter analysis of our process, product and financial data. Our goal should be to intentionally identify areas for improvement to make our operations smarter at least a project each month.

We also need to be friendly, seen as a good place work, safe and clean.

To be smart and friendly, we need to be clean. In the advanced manufacturing centers: America Makes, Lift, DMDII; they are commissioned to not only develop manufacturing technology but also to do workforce development. Each organization was required to build a state-of-the-art technology center. You would recognize the type facilities they built. They are the same as the manufacturing plants of our major OEM customers, large, spacious, clean and well lit.

We are not.

We need to be.

How can we do that?

I think we need to make cleaning our facility a priority, like quality improvement, safety, financial profitability, smart manufacturing and workforce development. In fact, these are not separate or separable tasks but different aspects of the same progress we need for our future. Clean is an essential part of 5s, 6sigma, safety, etc.

Our customers, especially our new customer quality and purchasing people look at our plant and are confident we cannot meet their quality goals given the appearance of our plants.

So, we need to, as a part of our ordinary improvements, clean our plants.

Like many of you, I had parents from the depression. We did not throw away anything. So, I find it difficult to get rid of tools and supplies even when I update and make the existing stuff obsolete. But we know from the 5s implementation, that stuff gets in our way and makes us less successful.

So, we need to, at a minimum:

- Landscape the odd parts of the exterior of the plant to avoid storing obsolete stuff outside the plant. The landscaping will not only improve our reputation with neighbor, getting that stuff either stored as valuable or discarded as scrap will make our operation more efficient.
- Improve, update our lighting and layout for workers. This is an area where it seems to me many plants are ahead of the game.
- Clean and paint. One reason our plants are easy to target for the silica regulations is the dark unpainted interiors that are dirty. This leaves the mistaken impression that we have a systemic and ongoing problem with silica exposure. Our customers are skeptical of our quality. Our neighbors are concerned about our safety and environmental impact. Our best tool to reduce these concerns is to have a clean, painted and well-lit plant.

I know that we are not there and have a way to go and are financially stressed and short-handed and have other priorities. But when I look at the leadership and profitability of the best steel foundries in my career, they were all seen as immaculately clean. These few high performing plants all had management that was less overcommitted and had more time for improvement. Yet when you took a plant tour, they would stop to pick up a piece of trash, get a supervisor to clean up a spill, get a maintenance person to fix a cracked window on a door. This attention to detail was reflected in their casting quality and the production efficiency.

So, I would advocate making cleaning and improving the plant a part of your goal to make your plant more profitable and valuable.

Raymond

**STEEL FOUNDERS' SOCIETY OF AMERICA
BUSINESS REPORT**

SFSA Trend Cards (%-12 mos. Ago)	12 Mo Avg	3 Mo Avg	July	June	May
Carbon & Low Alloy					
Shipments	-0.8	13.3	15.0	12.9	12.1
Bookings	8.7	18.5	21.0	17.0	17.5
Backlog (wks)	7.4	8.7	8.0	8.0	10.0
High Alloy					
Shipments	-2.7	4.1	1.0	1.2	10.0
Bookings	4.3	13.5	10.5	15.0	15.0
Backlog (wks)	7.4	8.7	9.0	8.0	9.0
Department of Commerce Census Data					
Iron & Steel Foundries (million \$)					
Shipments	1,359.5	1,292.7	1,282	1,294	1,302
New Orders	1,401.8	1,366.3	1,345	1,371	1,383
Inventories	1,982.3	1,961.7	1,997	1,960	1,928
Nondefense Capital Goods (billion \$)					
Shipments	71.0	71.5	72.7	71.2	70.6
New Orders	71.1	74.1	67.8	84.5	70.0
Inventories	173.8	177.3	177.5	177.9	176.6
Nondefense Capital Goods less Aircraft (billion \$)					
Shipments	63.0	63.4	64.1	63.3	62.9
New Orders	63.6	63.7	64.1	63.5	63.5
Inventories	120.5	122.7	123.1	123.1	121.8
Inventory/Orders	1.9	1.9	1.92	1.94	1.92
Inventory/Shipments	0.0	1.9	1.92	1.94	1.94
Orders/Shipments	0.0	1.0	1.00	1.00	1.01
American Iron and Steel Institute					
Raw Steel Shipments (million net tons)	7.3	7.6	7.5	7.7	7.7

Research Review

The Research Review meeting was held on June 13-14 at Rosemont, IL.

UNI (J. Thiel) opened up the meeting with updates from their Additive Manufacturing Center. They are currently working to improve the surface roughness of castings and resolution of 3D printed molds that would be comparable to investment castings. Surface finish of 560-900RMS can be achieved with 3D printed molds while investment casting can achieve 100RMS. UNI is also investigating non-silica alternatives as a response to the tightening silica regulations. They are examining the green sand properties and thermal expansion characteristics of ceramic aggregates. UNI is also working with AFS on determining the effect of water quality on green sand properties. Four salts: sodium, calcium, magnesium, and chlorine, were found to be predominant. A Taguchi L8 design was used to evaluate the effect of these contaminants.

MS&T (D. Van Aken) presented their carbide stability and quench sensitivity studies for a high strength low alloy steel, AF9628, which has gained interest in military applications. It was found that homogenization temperature higher than 1850°F is needed to completely dissolve carbides. Tensile and Charpy samples representing different section thickness (cooling rates) were tested. Slow cooling rates reduced the yield strength and CVN energy while no effect on ultimate tensile strength was observed. The effect on ductility was inconclusive. Retained austenite increased with decreasing cooling rate.

ISU (S. Chumbley) discussed the latest results for the ferrite prediction in CD3MWCuN. Using the point-count method, it was found that rates below 200°C/hr resulted to significantly low ferrite and high amount of sigma phase; however, these cooling rates are way below what foundries deal with. It was suggested that higher than 300°C/hr should be used for future heat treatment trials. The major alloys, nickel, molybdenum, and chromium, were varied. Once enough data are collected, development of a modified Schaeffler will be planned. The results for the cold spray project being investigated as a method to repair CA6NM were also presented. Artificial cavities were drilled and cold sprayed with 316 stainless steel powder. Unfortunately, 30 out of a total of 50 cavities were unfilled. Cold spray process parameters were adjusted and another plate, CE3MN, was cold sprayed. Results for this 2nd trial is to follow.

ISU (F. Peters) provided updates on the digital surface standard and the automated manufacturability analysis software (ANA), which was developed to provide early-and-often feedback to design engineers. The digital surface specification is still being refined while the ANA software is almost completed. A potential research on hybrid manufacturing was presented for industry input. The idea is to print metal to create features that are challenging to cast. Challenges such as process qualification were discussed and will be considered before project pushes through.

UAB (C. Monroe, R. Foley, J. Griffin) discussed the results and analysis of FeMnAl forging trials for the cast preform program. There were some challenges in forging FeMnAl. The temperature used was too high which caused some incipient melting in the test castings. It was discussed that the test castings be homogenized first to ensure segregation is minimized. Additional FeMnAl test material will be cast by UAB for further evaluation. This work has generated interest from the Army on using FeMnAl cast preforms for track shoes. UAB also presented the automated image analysis they are developing. It is currently being refined in conjunction with digital radiographies. This image analysis method expands the UI work on the digital radiography standard developed a couple of years ago.

Recent developments on UI's (C. Beckermann) air entrainment model were given. Simulation was run to mimic what was done in the water modeling trials in the Clean Steel Program. The air entrainment prediction from this UI model matches the trends found by UAB in the earlier water modeling trials. This modeling tool would be extremely helpful in evaluating different gating systems. UI also presented updates on the porosity prediction tool for manganese steels. The model is still being developed but the simulated porosity now more closely matches the experimental findings. Another project that was discussed was the counter-gravity with pressurization casting system. This seems to be a viable casting process to successfully cast without visible centerline shrinkage.

A summary and an overview of all the current research projects with different university partners can be found on the SFSA website at <https://sfsa.org/research.php>