



SFSA CASTEEL REPORTER

Steel Founders' Society of America

a publication serving
SFSA steel casting industry members

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July — 2021

Casteel Commentary

One change in the North American economy that we have noted in the past is the domination of services compared to manufacturing. This affects trade policy, where gaining advantages for services in trade is a priority over products. Another distortion from an investment standpoint is the inclusion of intellectual property in the statistics for capital investment. Historically, capital investment was fundamental to economic growth providing the improvements in productivity that were an essential component of growth. Including IP into the investment numbers obscures the declining investment in equipment and plants for manufacturing. This is the topic of this month's Casteel Commentary.

Research Review, August 3-6

Please make your plans to participate in the annual SFSA Research Review Aug 3-6. This year's meeting will be hybrid: Aug 3-4 will be held in-person at Four Points Sheraton, Chicago O'hare and Aug 5-6 will be virtual. The Review covers the latest in both Carbon & Low Alloy and High Alloy steel casting research and is your opportunity to interact with the researchers and provide industry steering. The event vets our research portfolio to select the R&D projects to be featured at the National T&O. Registration is required and must be completed by Thursday, July 29: <https://sfsa.site-ym.com/event/rr2021>. For questions, contact Diana David ddavid@sfsa.org.

Sensors in Steel Foundries Webinar

UNI will host a seminar on Wednesday, July 28th at 10:00A CDT to talk about their research, using sensors for Smart Data, and the launch of our SFSA/UNI Sensor Collective. All interested members are encouraged to participate as this will both serve as an opportunity to learn how to start implementing sensor technology, but also to work collaboratively to advance the development and use of sensors for Smart Data in steel foundries. If you are not able to attend the live event, but are interested, you can watch a recording of the webinar within a couple of weeks after and still join the launch. Please register [here](#) by Friday, July 23rd.

Research Highlight: Equal Channel Angular Pressing

Texas A&M has completed their work studying Equal Channel Angular Pressing (ECAP) as a way to increase mechanical properties in two high-performance steels: lightweight aluminum manganese steel and high yield low alloy steel. ECAP preserves the cross-sectional area in between passes, allowing for multiple passes with different rotations to study multiple rotation combinations and the effect on grain size. Project objectives included: 1) to develop processing strategies for refining grain size using ECAP; 2) to study the effect of ultrafine grains and high dislocation density on precipitation kinetics, precipitate size, and precipitate distribution; and 3) investigate the role of grain refinement and fine precipitate distribution on the room temperature mechanical behavior of both alloys.

Lightweight aluminum manganese steels offer great potential as a high strength material for critical applications. Precipitation hardening is used to increase the strength of these steels at the expense of ductility. In addition, precipitation distribution in the microstructure is not always homogeneous, causing anisotropic mechanical behavior. TAMU linked this anisotropic behavior to chemical segregation bands detected using wavelength-dispersive x-ray spectroscopy. Uniaxial tensile test results showed the presence of these chemical segregation bands have a strong influence on the mechanical properties.

Both high-performance steels were exposed to ECAP to assess its full potential for enhancing strength by reducing elemental segregation, refining grain size, and increasing dislocation density. Results showed a decrease in segregation resulting from a more homogenous precipitate distribution, which increases the dislocation density and leads to a higher strength and ductility combination. Their work also demonstrated that ECAP successfully refines grain size to simultaneously improve strength and impact toughness. Overall, these findings demonstrate that ECAP, via severe plastic deformation, can achieve excellent mechanical properties for high performance, lightweight steel alloys.

75th T&O Conference

Planning for this year's conference is underway including the celebration of the T&O's diamond jubilee. Please mark your calendar for December 8-11 in Chicago at the Loews Hotel for an in-person meeting. Please contact [Dave](#) for any questions.

Fall Leadership Meeting

[Registration](#) is now open for the Fall Leadership Meeting on September 11-14, 2021, at the Omni Grove Park Inn in Asheville, NC. SFSA staff and Board look forward to welcoming everyone back in-person to this essential meeting for leaders in the steel casting industry to learn, strategize and network. In fact, the Society is offering a [free member registration](#) with each paid member registration (cannot be used for spouses). Also, a reduced rate has been established for first time attendees, spouses, and SFSA Alumni (not eligible for BOGO).

This year's business sessions will include presentations from Peter Macler on Applied CapEx Planning and Management, Rod Eggert on Critical Raw Materials and Manufacturing Supply Chains, Max Falcone on Material Removal Automation Technologies, Joe Pickard on Scrap and Commodities Markets, Skip and Martha Guimond will provide an EHS Regulatory Update, SFSA market forecast, and an industry roundtable.

The Society has also arranged several optional group activities for members and spouses which include whitewater rafting on the French Broad River, Brew Cruise, and activities on the Biltmore Estate.

Make your plans now to attend - <https://sfsa.site-ym.com/event/FLM2021>

Market News

The SFSA trends show steel and stainless bookings remaining strong with shipments for both now 10% over year ago levels. The reported backlogs for May leveled out at 9 weeks for steel castings and 10 weeks for stainless. According to ITR, the steel casting markets for construction, mining, heavy-duty truck, machinery, and defense are all projected to remain in an accelerated growth phase through early 2022. Oil and gas production recovery has remained slow as producers have been reluctant to increase output despite higher oil prices. Steel prices remain at an all-time high. AISI reports that YTD steel shipments are up 8% through May over the prior year with capacity utilization rate at 83%. The price of copper remains high but has pulled back some in recent weeks. Department of Commerce numbers for new orders and shipments for iron and steel foundries and nondefense capital goods also support a continued growth trend.

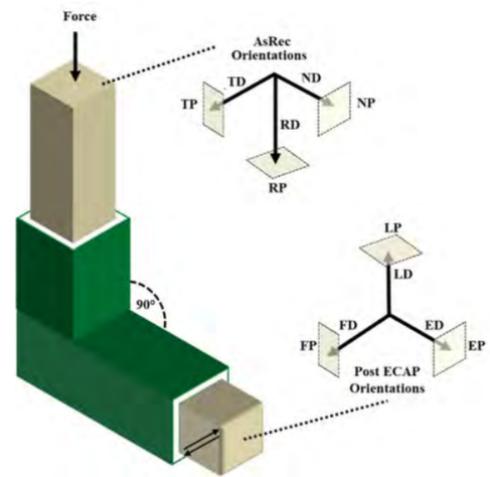
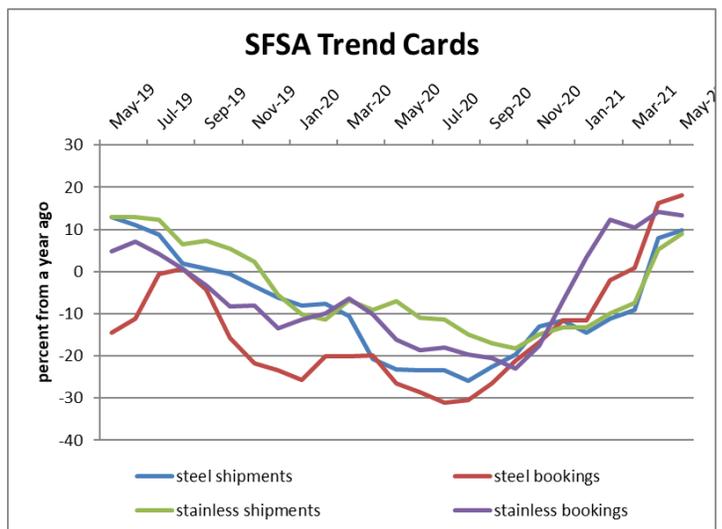


Figure 1: Schematic illustrating the ECAP process of HY-100 billets, following route E. ND: Normal Direction, TD: Transverse Direction, RD: Rolling Direction. LD: Longitudinal Direction, FD: Flow Direction, ED: Extrusion Direction. Planes are normal to the direction of interest, e.g. NP is the Normal Plane, etc.



Casteel Commentary

Economic growth is dominated by two factors, the increase of the workforce and the improvements in productivity. Last month we considered the limits of the declining population growth on the workforce and the need to automate. Our economic policy has benefited services, especially financial type organizations, and limited investment in plant and equipment. The statistics for capital investment show a slowdown but not a dramatic decline but our reality appears to be a significant laceration on investment in capital intensive manufacturing like our steel foundry industry. Some of this is due to global supply but that is not a complete picture since non-North American firms in developed economies have been prominent in investing in these capital-intensive industries.

The purchase of ESCO by Weir, Americast by Bradken by Hitachi, Hensley by Komatsu, etc. shows that our plants are not unattractive but are not considered a good investment in the North American financial community.

One reason the reported capital investment levels do not reflect the declining stock of equipment in manufacturing industry is the inclusion of intellectual property (IP) in the valuation of industry.

Table 2. Market Value and Intellectual Capital of U.S. Industries, 2009⁴

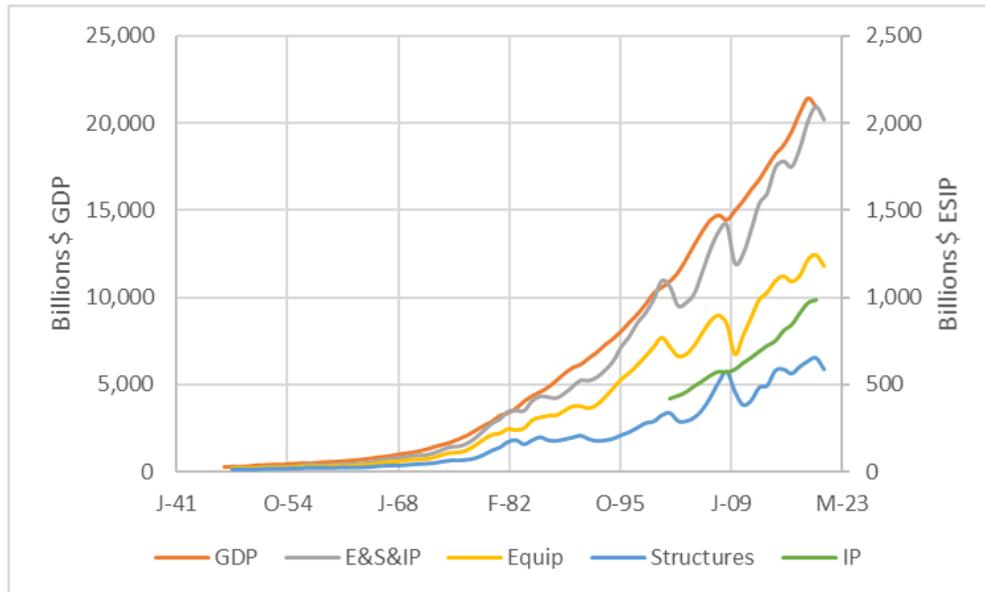
Industry	Intellectual Capital (\$ Billions)	Market Value (\$ Billions)	Intellectual Capital as a Share of Market Value
Energy	\$773	\$2,027	38.12%
Software and Services	\$749	\$1,408	53.24%
Insurance and Other Finance	\$745	\$1,914	38.93%
Capital Goods	\$632	\$1,313	48.18%
Pharmaceuticals, Biotech, Life Sci.	\$532	\$1,019	52.17%
Technology Hardware, Equipment	\$495	\$1,053	47.00%
Food Beverage and Tobacco	\$443	\$764	57.94%
Media	\$378	\$504	75.07%
Materials	\$349	\$737	47.42%
Healthcare Equipment and Services	\$348	\$650	53.60%
Telecommunication Services	\$292	\$406	71.92%
Retailing	\$267	\$610	43.69%
Diversified Financials	\$212	\$1,074	19.77%
Semiconductors and Equipment	\$191	\$440	43.41%
Household and Personal Products	\$182	\$300	60.82%
Consumer Services	\$170	\$339	50.34%
Food and Staples Retailing	\$161	\$383	41.97%
Transportation	\$142	\$293	48.53%
Real Estate	\$139	\$462	30.10%
Banks	\$133	\$554	23.98%
Automobiles and Components	\$133	\$213	62.26%
Consumer Durables and Apparels	\$104	\$225	46.33%
Commercial & Professional Services	\$91	\$162	56.15%
Utilities	\$4	\$510	0.77%
TOTAL	\$7,665	\$17,360	44.16%

https://www.sonecon.com/docs/studies/Value_of_Intellectual_Capital_in_American_Economy.pdf

This value may be appropriate in financial analysis but it does hide the ongoing lag in needed capital investment in equipment necessary to retain the capacity needed to support our domestic economy and provide for our national security. We saw some of this in shortages during the pandemic. It is also apparent in the challenges that defense industries have in finding qualified suppliers for critical items.

This distortion can be seen in the graph below. The top line documents the growth of the GDP. The Equip line is the reported levels of investment in equipment and the Structures line is for the same investment in structures. The IP line is for intellectual property. The total for E&S&IP is also shown. The E&S&IP line is consistently 10% of the GDP. Like the table presented earlier, the IP is slightly less than half the investment in equipment on an annual basis.

<https://www.bea.gov/system/files/2019-12/Chapter-6.pdf>



The investments in equipment are dependent on market conditions and can be well below 10%, for example from 2009 to 2011. For the past twenty years, investments are below traditional levels, and a growing portion of the investment is in IP. Our hollowed-out manufacturing infrastructure will need higher levels of investment based on higher profitability. This may occur as the lack of capacity results in shortages that results in more profitable pricing. This may occur as the excess investment seen in the current historical high equity valuations with implied low rates of return transitions to chasing manufactured goods that are in short supply. Inflation in the 1970's was a driver for the investments that built the infrastructure of our industry. The current excess spending and debt may be the fuel needed for the rebuilding of a profitable domestic industry.

Raymond

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

SFSA Trend Cards (%-12 mos. Ago)	12 Mo Avg	3 Mo Avg	May	April	March
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Carbon & Low Alloy

Shipments	-10.1	9.7	5.5	21.2	2.5
Bookings	-7.8	18.1	18.5	26.3	9.6
Backlog (wks)	8.3	8.9	7.8	11.0	8.0

High Alloy

Shipments	-7.7	9.1	11.5	18.2	-2.5
Bookings	-2.9	13.3	14.5	17.5	8.0
Backlog (wks)	9.2	9.5	8.5	10.0	9.9

**Department of Commerce
Census Data**

Iron & Steel Foundries (million \$)

Shipments	1,203.0	1,259.0	1,297	1,246	1,234
New Orders	1,308.8	1,423.0	1,468	1,394	1,407
Inventories	2,144.6	2,303.0	2,309	2,297	2,303

Nondefense Capital Goods (billion \$)

Shipments	73.1	77.2	77.7	78.2	75.8
New Orders	71.3	80.9	83.8	81.4	77.4
Inventories	194.6	196.9	197.4	196.6	196.7

**Nondefense Capital Goods
less Aircraft (billion \$)**

Shipments	69.7	72.6	73.3	72.6	71.9
New Orders	71.1	74.7	75.4	75.3	73.3
Inventories	128.9	131.4	132.4	131.3	130.7
Inventory/Orders	1.8	1.8	1.76	1.74	1.78
Inventory/Shipments	0.0	1.8	1.81	1.81	1.82
Orders/Shipments	0.0	1.0	1.03	1.04	1.02

American Iron and Steel Institute

Raw Steel Shipments (million net tons)	7.0	7.9	8.0	7.8	8.0
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