The metalcasting industry’s progress is revealed in the work of individuals, and one man’s progress reveals the truth that R&D must accommodate practical applications, and vice versa.

The FM&T Hall of Honor recognizes Dr. Alan P. Druschitz, whose experience in research, manufacturing, design, and in education that inquiry must be guided by practicality, and that technological progress is useless without understanding.

There are similarities in every story of every man and woman who devotes their energies, their career, their life to metalcasting. The casting process fascinates them. They have mentors and colleagues whose achievements they emulate or extend. They have a series of accomplishments that reveal deeper truths about science and humanity. And each of them recalls with clarity the moment when first they were fascinated by metalcasting.

In those details, Dr. Alan Druschitz is no different than his cohort, but there is something more about his experience that earns his recognition in the Foundry Management & Technology Hall of Honor, and at the same time makes his tale a ledger in which to read the course of metalcasting progress over the past four decades. They were decades of technological progress and organizational turnover,
an era that nonetheless led to the current moment – with both the science and the industry on the verge of new growth possibilities.

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And through these decades Dr. Druschitz — Associate Professor at the Department of Materials Science and Engineering at Virginia Tech; Director of VT-FIRE (Foundry Institute for Research and Education) located at the Kroehling Advanced Materials Foundry; and Foundry Educational Foundation Key Professor — has demonstrated in research, in manufacturing, in design, and in education that inquiry must be guided by practicality, and that technological progress is useless without a dedication to understanding causes and effects.

It happens that his experience also illustrates the deeper meaning of all the changes in the metalcasting industry over that past four decades. The shifting circumstances of owners and operations is undeniable, but the increase in metalcasting process capabilities, the expansion of technological resources, the surge in development for new products and materials, and the acceleration of more detailed knowledge about all of these things — all are evidence of progress.

Alan Druschitz grew up in Chicago's western suburbs, not in a place or even a family in which metalcasting was already embedded. The son of a mechanical engineer and a nurse, he had an unrefined instinct about the link between ideas and results. “I always had an interest in mechanical things,” he recalled, and did a lot of work in modeling. Plastic models, and then radio-controlled airplanes. I enjoyed the design and building of airplanes. I wasn’t so great as a flyer of the airplanes as some of my friends were, but the more technical aspects of design, construction, materials, I really enjoyed that. It gave me something to do, and because of that, when I was in high school I tended more toward chemistry and math, the sciences and the engineering skills.”

Inspiration at IIT

None of that provided any clear goal when he graduated high school and entered the Illinois Institute of Technology in Chicago. “I didn’t really want to be a mechanical engineer,” Druschitz said. “I liked the aircraft and aerospace world but at that time they were doing a lot of layoffs in that industry, so I started college in (studying) chemical engineering. And I knew chemical engineering would allow me to switch to anything else.”

However: “I knew I didn’t like electrical engineering. I never have understood things you cannot see,” and so he gravitated toward materials engineering. “I just fell in love with metallurgy and materials at that time,” he recalled.
There was another consequential discovery at IIT. “I really liked the professors there,” Druschitz said. “The Metallurgy Dept., like most materials/metallurgy departments, was very small. My whole class was seven or eight students. But, a lot of professors came from industry, and then moved into teaching. I thought that really worked out well because they taught us the theories, the understanding of the science, but they always had the practical, real world insights included in their lectures.”

There was a benefit to the intimate scale of this program. Druschitz came to appreciate the individuals as well as their skills and the insights they delivered. “There was nothing they wouldn’t do for a student,” he said. “If you were interested in studying something, they would help you with that.”

He listed his IIT academic advisor Paul Gordon, who had worked on the Manhattan Project and wrote books on diffusion, and the Metallurgy Department head Norman Breyer, an expert in failure analysis. “They all gave us good, practical engineering experience to go along with the science, and I just thought that was a super combination. And it kind of leads up to where I am now. It was probably partly the experience of having had those kinds of professors.”

There was a benefit in the location too, being near to steel mills on Chicago’s South Side and in Northwest Indiana, he was able to see metallurgy in action. The atmosphere at IIT was so agreeable he stayed on after he earned an undergraduate degree in 1978, starting immediately in the doctoral (Ph.D.) program there.

**Discovery at GM Tech Center**

Still a young man, with a Ph.D. in materials science and yet no obvious target for his inquisitional nature, it seems natural that Alan Druschitz would find himself among a thousand or so other doctoral graduates at the General Motors Technical Center in Warren, MI — a mile-square campus of scientific and industrial inquiry, with teams at work on every sort of project, conceptual, theoretical, and practical, in physics, electronics, chemistry, metallurgy and materials, and more besides.
“In 1982 we were coming out of a recession, and GM was in the process of building up its research efforts, and they were hiring essentially only Ph.Ds. to conduct research,” he explained. Some of the more senior staff were not so well credentialed, “but understood the manufacturing and commercial dimension of the work so much better than the scientific aspect of it,” according to Druschitz.

Both details seemed to matter to him, and as such his most revealing recollections of the GM Tech Center are of the collegiality of that experience. “What GM did was team up a younger guy with a more experienced, older guy, and I don’t think that happens much anymore. They assigned them to go around on different tasks together until the older guy felt the younger guy was ready to go off his own. It’s great to have a mentor when you’re just starting out, and at a big company like GM just trying to figure out the system can be a challenge: How to get things done? Who does what?”

The same atmosphere also provided some crossbreeding of expertise. “They had physicists, biomechanical people, mechanical, electrical, you name it — it was there,” he said. A conversation overheard in the cafeteria — involving the failure of a mold in a vacuum casting trial — brought about the contribution of a chemical engineer, who recognized (and then helpfully documented) a pressurization problem with the casting by treating it as a filter. Druschitz admits he never would have sought the involvement of GM’s fuels and lubricants experts, but the fact that Tech Center put the researchers together in such an environment proved valuable. “They did seminar series that way, too,” he said. “Trying to get people together, is a great idea, and it sounds easy but it’s not something that you can assign them to do.”

**Revelation at GM Defiance**

Progress requires practical applications, he agreed when prompted, but even after six years and many such applications at the GM Tech Center, Alan Druschitz had not yet experienced that moment of fascination with metalcasting.
The moment finally arrived in 1988, when a metalcasting problem resulted in a six-month placement at GM’s iron foundry in Defiance, OH.

“The first foundry I ever walked into was the biggest foundry in the world,” he mused. “I think in those days they were melting 600 tons per hour of gray iron, with multiple cupolas, and I think there were 18 Disamatic lines pouring ductile iron. I was working with the chief metallurgist there, Walt Chaput and I was immediately hooked on foundry processes, melting and molding, and making castings.”

All of his fascination with models, with materials, with phase transformation, and structures seemed to be in progress, in practical application, and on a grand scale.

“Metallurgy gave me the chance to heat things, quench them in water, break things open to look at the microstructure, and to try to relate processing to properties, and when you get into the foundry you’re making the metal ... adjusting it to get the chemistry correct. And then it goes into the mold ... I always tell the students in our casting class that once you get into the foundry you’re either going to love it or hate it, you’re either fascinated or terrified, and if you’re fascinated, welcome. We’ll be doing things that will keep you fascinated for as long as you want to stay.”

He sees now that most people involved in metalcasting have an earlier exposure to it, and that he had been searching for something that would define and fulfill all his interests. “GM allowed me the opportunities to do a little bit of everything, and gave me time to focus on what I really wanted to do,” he said with appreciation.

But he emphasized that there is always someone who has the task of introducing a person to the foundry, and for me it was Walt Chaput, the chief metallurgist at GM Defiance. Druschitz said he once told the mentor he’d like to have the same job, but was quickly cautioned not to exaggerate his fascination with the process. “He told me, ‘You’re having the fun part going around the plant, working with the metal, the castings, the heat treatment. I’m an administrator.’ ”

He noted the distinction, and indicated he learned the necessity of working effectively with everyone in a manufacturing enterprise, management and union labor, degreed technicians and skilled workers. “You have to be able to work with people that are on the plant floor doing things,” he insisted. “A single-focused researcher may be able do things on his own, but in a manufacturing environment, even if you have a great idea, unless the people that are there to implement it believe in what you’re doing, it’s not going to happen.”

Druschitz said he spent six months indulging his new calling at GM Defiance, and then returned to work in the foundry at the GM Technical Center, getting more focused on metalcasting research, and
involved in the GM corporate casting development program. He gained understanding and experience across the range of GM’s operations during that period of reorganization, from a centralized foundry organization to a functional part of the powertrain product line. He recalled how every detail of that organization now seems massive in concept and execution, and that the change from that time to now is instructive, because it proves that practices can be changed to incorporate shifts in technology, commerce, regulation, or organization.

Druschitz had a role in numerous R&D efforts for GM in the early 1990s, working as research engineer at the GM Tech Center laboratories, as well as on the corporate level with the technical directors of GM’s casting operations. Those were discussions about the future of GM engine programs, “a much higher-level focus,” he said. His particular involvement was with the development of lightweight thin-wall castings.

“GM was always trying to take weight out of the components, and they had a vacuum-casting process they were developing with Hitchiner, and we were doing some lightweight stuff with just simple gravity-pouring,” Druschitz recalled. “It was kind of interesting how we’d develop something and then real-life would set in,” he said, returning to the theme that research must accommodate practical applications, and vice versa.

“We’d realize we could make differential cases with 3 mm wall thicknesses, and we could actually pour them, but we’d destroy every one of them in the plant,” he said, explaining that the handling and machining systems in GM’s foundries were not prepared to handle products that displayed such dimensional precision.

“We had great ideas and we developed great technological capabilities, we’d cast parts with 1-mm wall thicknesses, and 2-mm wall thicknesses,” he said, “but they were not really getting anywhere in the organizational plans.”

A particular example he recalled was a front shock tower, lower control arm mount designed to “glove” over the hydroformed rails of a 1994 Corvette chassis. New modeling software made it possible to redistribute loads and increase component stiffness where necessary; the part was cast in steel — to acclaim from performance engineers at GM’s test track. Unfortunately, a seemingly small increase in cost scuttled the part’s prospects on the ‘Vette.

**Demonstration at Intermet**

Some frustration with GM’s organizational complexity may have encouraged Druschitz to accept an invitation to join Intermet Corporation in 1996, a chain of ferrous foundries still growing at that time. The company wanted someone with metalcasting experience to join its research operations in
Lynchburg, VA, “someone with problem-solving skills, a researcher, and also someone with an automotive background ... I was not looking – but I was interested,” he confided.

Intermet not only provided the chance to work with a more focused, foundry organization, but to implement new production technologies and to market those improvements to the automotive industry.

“Bob Warrick was the most outstanding individual, and boss, I ever knew,” he recalled. The Intermet research head, who had recruited Druschitz with an eye for his own successor, set an example of organizational commitment together with the collegiality that had been so rewarding at IIT and the GM Technical Center. “His view was, ‘I look good if I make you successful in the company, and I develop you to be what you want,’” Druschitz explained. “To me, that was a different world from GM.”

Soon he had visited all of Intermet’s various casting operations and developed working relationships with the plant managers, general managers, technical directors, etc.

“At that time Intermet had eight or nine plants in the U.S. and one in Europe. ... All the technical directors and plant managers knew each other. And we were all trying to make money by making castings, so everyone was working together. We had a small technical center group that did product design, and a nice research foundry.

“We had a pattern shop, we could make molds, melt metal – or if we needed a lot of metal we’d take a mold into the plant, or have them bring a ladle over. We could heat treat castings, perform metallography and mechanical testing ... it was just a candy store of metallurgy and metal casting,” he said.

Intermet’s focus was castings — on the current business program, and on attracting new casting business for the future — and Druschitz welcomed the opportunity to link research projects more directly into the group’s operations.

It was also a time of significant technological change in foundry processes. “In the mid 1990s was when we were starting to go through the change from blueprints and drawings to math-based data,” he detailed. “We were starting to do modeling simulations. Finite element analysis for stresses was widely used, but we were really just getting into the casting simulation technology.”

This is a significant point, and difficult to recognize based on current practices. Prior to the mid-1990s, every casting produced was based on a blueprint. The analysis of the design came after it had
been produced. Druschitz acknowledged that some math-based analysis had been used in GM’s casting operations, but in remedial ways — to correct shrinkage, for example.

Today, CAD is the basis of every part, and students learn to operate CAD programs early. Drafting skills may be lost now, but math-based design is standard, and it’s that fact that make casting simulation possible.

“When I was at Intermet we were going through that change where they were starting to generate the math data, and Intermet made the decision to establish a product design group,” he explained. “So, if we got the envelope that the part had to fit, the weight requirements, the attachment points, and the loads, we would design the part. And our thought was that we wanted to be a full-service castings producer. We’d design the part, tool it, prototype it, and then part of my group – the Intermet Materials group – put in the component testing equipment so that we could validate designs.”

It was a huge investment by Intermet he recalled, but the company was growing, acquiring new locations, and a re-trenching auto industry seemed willing to let foundry suppliers handle some part of their design work — if only to allow them to shop the design to lower-cost suppliers. It would be a sign of the dilemma that Intermet and other foundries were drawn into as the 20th Century wound down.

But that eventuality did not deter the R&D progress that Intermet made. “Our emphasis was to develop thinner-wall, lighter weight castings,” Druschitz explained, “and that also drove us to develop capability with austempered ductile iron (ADI), and then intercritically austempered ductile iron (IADI), which I worked on a lot, to get to an iron material that had sufficient strength and ductility that we could use to design castings for higher loads.”

So much progress has been made with new materials in the past two decades that the factors driving each development, and the design changes that each one makes possible, and the practical changes that each one initiates, are overlooked. The drive for lighter vehicle components guided an enormous increase in the development and use of aluminum alloys. ADI and IADI were counter-efforts, taken by Intermet and other foundries to hold product categories where aluminum alloys were showing growth potential.

Druschitz had particular success developing IADI, a material with the high-strength characteristics of ADI but the machinability of pearlitic ductile iron. It was an important effort to develop materials needed to reduce weight for high-value automotive parts, like crankshafts, control arms, or steering knuckles.
The research resulted in numerous patents, bringing some recognition and satisfaction to Druschitz, but he does not hesitate to credit Intermet for providing the research facilities needed to melt, cast, heat treat, and test products on an appropriate scale.

In a wider sense, he credits his colleagues, both at Intermet and from other organizations such as the Ductile Iron Society

“My Intermet colleagues were very big on professional societies, and we try to encourage that now with the students, too,” he said, emphasizing the importance of collaboration in professional life as well as research. “I did a lot of automotive engineering work with SAE, and then started to work with AFS and DIS too, and eventually worked my way up to be the president of the DIS.”

Druschitz recently presented a research paper to the World Foundry Conference on the details of IADI production, closing a bit of a gap in the subject that had grown with the bankruptcy and liquidation of Intermet Corp. — more evidence that technical developments must be balanced properly with real-world conditions.

As his recognition of colleagues indicates, Druschitz was gaining an understanding that working with individuals to achieve practical results is the most reliable way to ensure the progress of one’s ideas.

**Rediscovery at UAB, Virginia Tech**

So, when Intermet’s dissolution seemed certain he began to consider that, after 25 years experience in industry, it might be the right time to emulate his IIT professors, and he found the opportunity in 2007 to head the metalcasting program at the University of Alabama-Birmingham’s Dept. of Materials Science and Engineering.

In addition to excellent teaching and research facilities, Druschitz noted he had numerous contacts to rely on in the foundry and automotive manufacturing industries, for references, explanations, advice, etc. And the metalcasting community in Birmingham proved exceptionally supportive to the
UAB students and program. It created a new dimension in research, he observed, because of the range of ideas, processes, and proposals that are available in that region.

There were adjustments to be made in regard to academic work: “There is still research to be done as a professor,” he explained, “and we’re expected to research and to teach, and to conduct student activities, but I felt it was already close to the kind of things I had done. I had taught some classes at the plants, and now I had to do much more of that.” While he expected academic life to be less hectic, he confesses now he was mistaken.

“The classes are there every week whether I am ready or not, so it’s a lot of preparation work for the classes, and there is still research to do, and there are graduate students with projects to complete,” he noted by example.

 Unexpectedly, in 2010, he was recruited from UAB to take a comparable role with a new metalcasting foundry built at Virginia Tech — a development long in the works by the AFS Piedmont Chapter, one that finally came to reality with financial commitments by a VT MSE alumnus and certain manufacturing companies. He was drawn back to Virginia, intrigued by the opportunity to oversee a virtually new teaching and research foundry.

“One of the things they explained was that they had built the new facility and had teachers to staff it, but they needed someone who knew how to run the foundry equipment,” and that resonated well with his first fascination with casting operations at GM.

Another change is the number of students in the Virginia Tech program. “My biggest class at UAB had nine students,” he said. “My biggest class at Virginia Tech had 65 students.”

The VT Materials Science and Engineering department has about 15 full-time faculty members, and four available to teach foundry classes. The program presents three categories for casting education: bonded sand casting, investment casting, and 3-D printed mold technology. Druschitz explained that the program had to establish a starting point when it was launched in 2011, providing the basis for development without limiting the prospects that new technology may introduce.

“We want our students to be able to walk in to a foundry and be immediately useful, but we also want them to be the ones that are able to change that foundry, so if it’s going to be there in 20-30 years with state-of-the-art technology, that is technology they don’t have yet,” he explained.

The Virginia Tech metalcasting program is available to students in materials science, mechanical engineering, industrial systems and engineering, and art and architecture. Students learn to design castings in CAD, to prepare molds and to melt and pour metal. Simulation technologies are
introduced, and different molding options (sand, investment casting, 3-D printing) are available for instruction as well as research.

After several years of experience, Druschitz has gained satisfaction with his teaching profession. And the enthusiasm and proficiency of the students has rewarded his determination to instill the collegial environment that has benefitted him throughout the years.

“My role is to teach them how to do something, give them one or two times to gain experience, and then define projects that they can use for practice,” he said. “They love the hands-on approach. We have two casting lab classes – a very short lecture and then out in the lab to make patterns, make molds, melt metal, pour castings.” There is great satisfaction in the ability to impart his own fascination to fresh minds.

“I love when we do elementary metalcasting,” he said, “and the first casting they make is little pattern in clay, and then they make a bonded sand mold, attach a gating system to it, and they pour it in iron.

“And when they break open their very first mold they get big smiles on their faces, and I can see their recognition that they made it. They made the pattern, they made the mold. They melted the metal, they poured. It’s great to see that. Then, by the time they get into the more advanced classes I am amazed by what some of the students have made.”

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