GAINING CUSTOMERS BY DEGREES

As silicon wafers are heated to produce today’s microchips, an important cast aluminum heater is at work keeping the process at the required uniform temperature necessary for efficient, high-quality mass production.

Cast Aluminum Solutions (CAS), in Batavia, Illinois, makes these heaters, along with a wide variety of thermal management parts for applications like blood dialysis, commercial food preparation, cryogenics and heating rocket fuel.

“We are a small niche provider that plays in major industries,” said Rick Ahern, COO, CAS. “Overall, we are growing. And we are always working with existing customers on the next-gen product.”

The cast aluminum heaters produced via permanent mold processes by CAS come in various shapes and sizes. The company offers a standardized line of circulation heaters (CAST-X Circulation Heaters) but most of its business is making custom heaters.
The key to the heaters are the cast-in cooling or heating elements.

“The unique thing about what we do is we achieve intimate joining to the heating element,” said Tony Meadors, vice president-sales and marketing, CAS. “Heaters that are cast-in perform more efficiently and last longer than those installed using non-cast techniques.”

The heating element is sheathed in a bendable stainless steel tube before it’s placed in a tool steel mold. CAS adds a support structure within the mold to support the location of the heating element and any other cast-in components. The castings are then poured in either a low pressure or tilt pour permanent mold machine.

Another way of making these components would be machining from billet and adding the heating element through various assembly and welding steps. Casting-in the tubing is more cost efficient and enables the heater to
These parts are utilized in applications with very tight tolerances, so they must be machined to precise specifications, and the heaters must maintain temperature windows as narrow as +/- 0.1 of 1°C.

In some instances, the heaters must also perform under a vacuum. The thermal elements must be carefully engineered through modeling to achieve the desired temperatures while working within the parameters of good casting design.

Thermal Design

One of CAS’ largest markets is semiconductor, which is a technology that has enabled significant development in computers and electronics.

“CAS heaters are involved in the front-end manufacturing of silicon wafers, which are the foundation of microchips containing millions of tiny circuits…the engine behind today’s cell phones, tablets and high-tech gadgets,” Meadors said. “These amazing things are made possible by our cast aluminum heaters, which deliver a high-tech, high-value-added solution at a low overall cost.”

Making a microchip is a very complex process. Thousands of circuits are produced on a single silicon wafer.
Microchip makers want to yield the maximum number of circuits off that platform.

“It’s a 12-in. piece of silicon, yet it has all this value,” Meadors said. “The industry is striving for smaller and smaller circuits and that means we have to have even more consistent heaters and part to part repeatability. Every heater we produce has to be absolutely perfect.”

At CAS, the design of a cast-in heater starts with thermal engineering—determining the best shape for the cooling tube or heating element to achieve a target uniform temperature. The CAS engineering team uses finite element analysis (FEA) to optimize its designs and migrate them to manufacturing. This process also employs process simulation models to evaluate and establish the location of flow-path tubes and heating/cooling elements within the mold.

“We look at things first from a thermal standpoint,” said Eric Hostert, CAS vice president–engineering and quality. “The heater’s location in the mold could affect the component’s performance. How the molten aluminum flows is also important. We can’t have voids or inclusions that might inhibit our products from achieving a uniform temperature.”

Maintaining a uniform temperature is important in myriad applications. In commercial quick-service restaurants, for instance, a consistent

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temperature on the griddle means every burger is repeatable, with consistent quality and no undercooking. While Hostert said 80% of the design work at CAS revolves around the heating element, achieving a consistent cast part around that element is also crucial. CAS developed PLC controls to monitor and augment key factors in the casting process, such as mold temperature, cycle times and the pressure used to eject the metal.

“A lot of the applications, such as wafer manufacturing, take place under vacuum and deal with potentially hazardous chemistry,” Meadors said. “These industries strive for safety and our heater is a part of this. It can’t leak under a vacuum. We’ve incorporated very robust monitoring and control mechanisms in-house, from X-ray and ultrasound testing to infrared and helium leak testing. We take no chances with quality.”

CAS, which employs 75 people, operates eight low pressure permanent mold machines and four tilt-pour permanent mold machines to cast parts up to 100 lbs. It pours 319, 356 and pure aluminum. Pure aluminum is used for the semiconductor parts.

CAS’s customer base is balanced among four main industries: food, medical, semiconductor and oil and gas. It also serves a range of other industries on a smaller scale.

“Like all companies, we have aggressive growth targets, and as the economy or a particular industry slows, it has an impact on us,” Ahern said. “That being said, we utilize our growth metrics as a way to challenge ourselves to find new customers and new industries.”

Industries like medical and semiconductor are constantly improving their machines, which means CAS has substantial repeat business.

“Our customers constantly update their machines,” said Jeff Awe, CAS marketing director. “So we always have a fair amount of new jobs from established customers. At the same time, we’re regularly contacted by startups, development engineers and firms in emerging industries.”

CAS has a large engineering staff that acts both to design the parts and as an extension of customer service.

“The customers come to us with problems and ask us to come up with a solution,” Hostert said. “We encourage our customers to be involved early and that usually saves everyone money.”

OEMs are usually not as well-versed in thermal engineering as CAS, so they rely on the supplier to come up with a way to achieve the desired temperature within the desired dimensions.

To further enhance company growth and balance the product mix, CAS offers a standardized line of
CASE STUDY: BLOOD ANALYZER HEATER

An OEM of blood analyzing equipment needed a method to heat and control the temperature of testing fluids. Initially, the customer designed an assembled block containing a coiled tubing and bonded silicon rubber heaters. This solution resulted in fluid contamination and corrosion, as well as leakage through the fluid path. In addition, the bonded silicon rubber heaters on the aluminum plates had poor heat transfer, causing inadequate temperature control. The OEM needed a better way to control its temperature.

Cast Aluminum Solutions (CAS) converted the original design to a one-piece cast-in aluminum component with tubular heating elements. This design significantly improved the heat transfer and eliminated the corrosion and leakage problems. Alodine, a protective external coating applied around the outside perimeter of the casting, reduced contaminants from the surface.

CAS also facilitated the subassembly, including the addition of sensors, switches, wiring harnesses and electrical enclosures, delivering a ready-to-use part to the customer.

circulation heaters. The CAST-X Circulation Heaters are available in multiple sizes and watt ranges from 1 to 60 kilowatts.

CAS was purchased five years ago by a small private equity group based out of Michigan.

“Our ownership group understands manufacturing and value added opportunity, and has been very supportive in providing us the capital to grow and improve the overall business,” Ahern said. “A significant portion of our investments have been in new equipment such as state-of-the-art CNC machining centers. We needed improved machining capabilities due to demand for tighter tolerances and geometries. It gives us capacity, time and repeatability, and allows us to add tremendous value for the customer.”

In 2015, the company was named “Manufacturer of the Year” in its county based on complexity of product, markets, scope, local sourcing, intern program and participation in the Alliance for Illinois Manufacturing.

“We’re also quite proactive with our marketing and finding new opportunities,” Ahern said. He sees growth for CAS coming not just in next-generation equipment from existing OEM suppliers, but from opportunities in developing sectors, such as cryogenics, where subjecting materials to very low temperatures can be useful in electric power transmission, blood banking, and the study of atoms. “We try to stay in touch with the industries we serve and learn about ones we are not in. We are always asking ourselves ‘Where is the next great idea coming from, and how can we participate in it?’”

This article appeared in the February 2016 issue of Modern Casting Magazine.

For more information on the line of CAST-X Circulation Heaters, please contact Cast Aluminum Solutions:

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Sales@CastAluminumSolutions.com
Tel: 888-367-3992

Cast Aluminum Solutions serves OEMs and end-users with precision-engineered heat-transfer solutions. The CAST-X line is available in several sizes, with a variety of circuitry, tubing and enclosure options. Located near Chicago in Batavia, IL, Cast Aluminum Solutions serves customers worldwide through our network of application engineers, representatives and distributors. CAS Engineers work directly with customers to develop practical, reliable solutions to critical heating applications.

CAS is an ISO 9001 Certified company.

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