Heat Treat 2013

Gear Market Offers Opportunities for Ingenuity and Innovation

Matthew Jaster, Senior Editor

Growth in the heat treating sector depends on many factors including product development, technology advancements, customer demand and a little luck. Successful organizations will have the right products available during strong market periods while investing in new technologies when the market slows down. Global expansion is essential as companies in the United States and Europe look to China and India for growth opportunities. In this issue, *Gear Technology* looks at various heat treat companies involved in the gear market today and the new developments leading up to the **27th ASM Heat Treating Society Conference and Exposition** that's co-located with **Gear Expo 2013** (September 17-19, Indiana Convention Center, Indianapolis). Engineers involved in this market segment see an emphasis on training, software, service/support and collaboration with their customers to remain relevant in heat treating moving forward.

Austempering with Applied Process

The Applied Process family of companies specializes in the austempering heat treatment process of steels and irons. "Austempered Ductile Iron, ADI, constitutes the majority of our work, and the remainder of our heat treating work is split between austempered steel, carbo-austempered steel, austempered gray iron, carbidic austempered ductile iron, and marquenched steel," says Justin Lefevre, regional sales engineer at Applied Process.

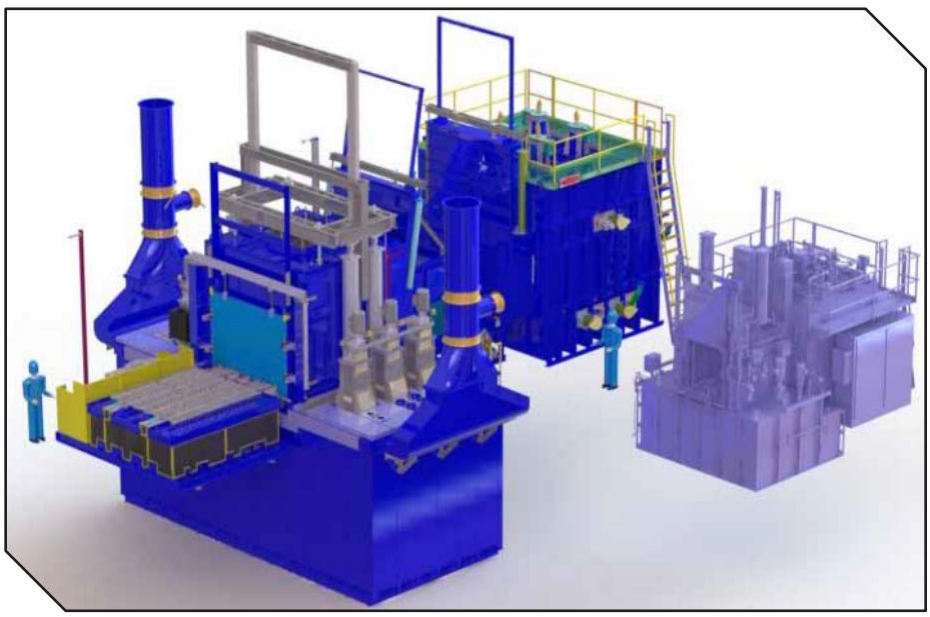
ADI offers gear manufacturers an opportunity to gain the manufacturing ease of ductile iron with properties comparable to some of the common steel gear heat treatments at a low product cost. "Austempered and carbo-austempered steel provide high performance solutions for applications where tooth breakage is an issue and redesign is no longer an option. The low levels of distortion attributed to austempering can help eliminate secondary machining processes, press quenches, and distortion issues," Lefevre says.

According to Lefevre, several of the most significant advances in heat treating today have been in the refinement of induction hardening methods and practices, shortening of the carburizing cycles, vacuum carburizing and quenching, and ion/plasma nitriding. The advances in these areas have led to lower cost and higher performing products with less waste/scrap.

"As the demand for lighter, more efficient power transmission systems grows, the optimization of gear material selection, processing and design will be critical. Tools to optimize gear and gearbox design will be critical in this process and could come in the form of software that optimizes gear design, new materials or advances in heat treatments," Lefevre adds.

"Quality heat treatment requires a capable system that is in control. Software, for example, plays a key role in the control of our austempering cycle development as well as the monitoring and reporting of our furnaces' settings and operating conditions. As technology and refinements of heat treating systems improve, so will the ability to integrate these system, where appropriate, in the manufacturing process. Certain types of heat treating processes lend [themselves] to integration in line with machining; i.e. induction hardening," Lefevre says.

Applied Process collaborates closely with manufacturers on many design projects, and often the most successful austempered parts arise from early engagement between the design engineers and Applied Process. "Growing the pie for austempering is our mission, and generating value through strategic



Applied Process and AFC-Holcroft joined together to produce a Monster Parts Universal Batch Quench-Austemper (UBQA) furnace (courtesy of Applied Process).

partnerships is a key part of this process. We engage in evaluation of the existing material, manufacturing methods, and application stresses of parts with designers. In doing so, often the optimum choice of material and manufacturing method is apparent, which sometimes leads to austempering business," Lefevre says.

Applied Process launched AP Monster Parts Division in 2012 in Oshkosh, Wisconsin with what is believed to be the largest universal batch quench austempering furnace in the world and added two furnaces in the Livonia, Michigan plant. In January 2013, the company hosted AP University for the first time to give customers an opportunity to learn about ductile iron design, foundry practices and austempering in general. "It was so successful that we have already planned another AP University for May of 2013. This, of course, is in addition to the 25-50 onsite presentations that we do for multiple customers every year."

As for overall business, it softened during the last quarter of 2012 but Lefevre expects 2013-2014 to show improvement especially in the larger gears for their new furnace. "We already have several projects underway that involve conversions to austempered ductile iron gears in the heavy industrial market; we cannot say much more than that about the projects. Our efforts in the near future in relation to gears are to focus on conversion opportunities in agriculture, mill gears, and automotive applications," Lefevre says.

Factors that will determine the future success of Applied Process include governmental policies and regulations that impede the growth of the economy, the company's ability to get austempering, specifically ADI (austempered ductile iron), as an accepted heat treatment/material in the gear-making/using community and the ability to produce property data that end users of gears require in order to specify austempering/ADI as a suitable material.

"Natural gas and raw mineral prices impact our cost model; however continuous improvements to our equipment help to mitigate these effects. The long term outlook for natural gas, electricity, and alloy costs are all positive for the heat treating industry. In other words, lower or stable prices will lead to stable prices for our customers," Lefevre adds.

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Aerospace Advantages with Solar

Low-pressure vacuum carburizing (LPVC) and vacuum gas nitriding (VGN) are the two main areas in which Solar serves the gear market. "The advantages include clean, bright parts with limited to no distortion," says Tim Steber, regional sales manager. The company also boasts an R&D department with metallurgist, scientists and engi-

neers on staff for consultation and oversight of work.

Solar's Souderton plant recently received a Nadcap accreditation in carburizing, allowing it to better serve the aerospace market. This accreditation joins Solar's other Nadcap approvals for heat treating, brazing and fluorescent penetrant inspection. Additionally, earlier this year the company became an approved supplier for General Electric Aviation (GEA), UTC Aerospace Systems (UTAS) and Moog Corporation.

Solar Atmospheres is comprised of more than 40 vacuum furnaces backed by NAdCAP Accreditations and certified by ISO 9001/As9100 (courtesy of Solar).

Don Jordan, vice president of R&D/corporate metallurgist, says that growth in the aerospace market has been significant for Solar, particularly with new high alloy grades developed specifically for LPVC including Ferrium C61 and C64, Pyrowear 675 and CSS-42L. "Our company collaborates with all prime rotorcraft (helicopter) aerospace companies and their suppliers," Jordan says.

Jordan believes that the most significant products and technologies in the future will be continued developments and advancements in LPVC and high-pressure gas quenching in vacuum heat treat processing of traditionally oil quenched alloys (e.g. 4140). Laser induction hardening will also play a significant role in multi-functional machining operations.

Trevor Jones, principal engineer at Solar says that software has an increased role in heat treating today. "Process modeling of LPVC parameters (time, temp, hydrocarbon) and the resultant hardness profiles. Process modeling of quench rates and distortion profiles as well," Jones says.

While business is good, hiring skilled workers and the rising costs of raw materials and energy remains a significant challenge. "Vacuum heat treating is not a well-known industry/science in the manufacturing world. Skilled workers have always been difficult to find and retain in our industry and remains true today," Jones says. "Raw material pricing of fixturing, electrical rates and process inert gas prices significantly affects the bottom line."

In order for future success the company will continue to develop surface treatments of materials, add furnace capacity and obtain qualified personnel.

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