

Innovative Developments in Thermal Processing

Surface Combustion Inc., Maumee, Ohio

Surface Combustion has been a leader in thermal processing equipment since 1915. Innovative developments over the past nine decades have been among the most sought after technologies. Whether atmosphere, vacuum, continuous, or batch furnaces, Surface believes constantly developing innovative, more efficient designs is the key to growth in today's dynamic business atmosphere.

Process control and flexibility. Well-developed products like Surface's Allcase® furnace line offers add-on capability to grow as production requirements grow. Similarly, Surface's new vacuum carburizing technology provides modular add-on capability of chambers as production scales up. The technology is based on a high-purity, low-cost carbon source that is easy to control, repeatable, and dependable.

The use of 20-bar high-pressure quenching offers the benefit of lower part distortion. The technology is available as part of the Surface Cloverleaf™ vacuum carburizing system. Gas quenching also eliminates the need for parts washing, as required with conventional oil quenching. Vacuum oil quenching is available for conventional lower grade materials. In addition to vacuum carburizing, the Cloverleaf also can do conventional vacuum processing such as hardening, annealing, and brazing. Cloverleaf furnaces equipped with both oil and gas quenching offer a heat treat that is the ultimate in flexibility.

The company's simple, rugged designs translate to years of dependable service with minimal maintenance requirements. Soon to be released is an enhanced version of Surface's Heat Treat Management (HTM™) software. The new system is easier to use and more powerful, providing data reporting, remote viewing, and load/part number tracking.

Environment. Surface offers patented gas-fired vacuum furnace designs in which the customer can substitute electrical heating with the fuel source for energy savings. RX® generators are the standard for endothermic gas, and with an industry-leading 6:1 turndown ratio, production consumption is minimized by automatic controls adjusting capacity needs. Maintaining heat by using recu-



Rich-fume incinerator.



Vacuum carburizing system.

perative technologies and simply by retaining heat in loads rather than cooling in between processing steps are also gaining more favor. Environmental concern for thermal processing exhaust emissions is growing, leading Surface to purchase the Morgan-Isley ejector stack product line and to make new developments in incinerators, such as ammonia incinerators for gas-nitriding furnaces, to enable better control of process off gases.

Reliability. Surface Combustion is known for rugged construction and long equipment life, and the company stands behind its equipment with Rebuild Retrofit and Aftermarket Services, including an inventory of original equipment spare parts and field service to maintain equipment or facilitate training of the next-generation workforce.

Surface continues to be a leader in the heat treat market by dedicating thousands of hours to various professional organizations, including many board-level positions and committee assignments in organizations such as the ASM Heat Treating Society, MTT, CHTE, and IHEA. In this way, the company offers its experience as a foundation for the advancement of the entire thermal processing industry. www.surfacecombustion.com.



Ejector stack.

Graphite Products Meet Specific Needs

GrafTech International Ltd., Parma, Ohio

GrafTech (formerly UCAR Carbon Co. Inc.) has been involved in developing innovative carbon and graphite solutions since its inception in 1886. Its GRAF-SHIELD line of graphite insulation, GRAFOAM carbon foam and UCAR Performance Graphite products are used in high temperature, controlled atmosphere applications.

The heat treating industry faces a unique challenge in its current growth phase. Historically high oil and energy prices are exerting cost pressure on graphite products, which use an energy intensive manufacturing process and petroleum-based raw materials. High energy prices and concerns about global warming have spurred adoption of wind and solar based energy generation leading to growth rates of about 15% and 30%, respectively, in those markets and a consequent demand for the high-temperature graphite insulation used in their manufacturing process. Meanwhile, the booming aerospace market, which is driving growth in the heat treating market, is consuming massive amounts

Trends in Ceramics Impact Thermal Processing

Blasch Precision Ceramics, Albany, N.Y.

There are a number of factors working together to make the future very bright for using ceramics in heat treating. Innovations continue to raise the performance of engineered ceramics to survive the challenges of heat treating applications. For example, new alumina-bonded materials provide better resistance to degradation in hydrogen atmospheres for both metal and powder injection molding (MIM and PIM) furnace-tile applications. Alumina bonding also provides high hot strength and resistance to hot load deformation for use in high temperature applications.

In addition, the price of metals is rising much faster than the price of ceramics. Consequently, as the cost of metals maintains its climb, it becomes increasingly more attractive to use ceramics in heat treating applications. Since the performance of ceramics typically surpasses many metals in heat treating processes, choosing ceramics is the smart choice for both performance and ROI.

Further, ceramic companies such as Blasch are constantly advancing the state of the art with regard to ceramic formulations suitable for heat treating applications and in sophisticated manufacturing processes that produce near-net-shape ceramic parts having tight tolerances, low shrinkage, and controlled porosity and density.

Expensive machining costs are avoided by casting rather than machining parts to the correct shape and dimensions. In addition to containing costs, this is significant because machining can introduce stresses and microcracks, which can potentially lead to premature failure of the material, particularly during thermal cycling. Since heat treatment often produces severe thermal cycles, and since thermal shock resistance is critical, the need to maintain the integrity of the material is paramount. www.blaschceramics.com.



Advanced ceramic kiln furniture.

of carbon fiber in its shift to composite bodies and structures. The confluence of these factors has led to a shortage of high-temperature insulation, which comes at a time when high energy prices have increased pressure on heat treating companies to reduce costs through improved furnace efficiencies and reduced cycle times.

To help alleviate this material shortage, GrafTech has invested heavily to increase its graphite insulation production capacity in 2007. In addition, GRAFOAM was introduced, providing structural strength to its insulative and handling properties. These products help reduce cost through lower energy consumption, improved furnace efficiency, and reduced cycle times. GRAFOAM, the strongest known thermal insulator for temperatures to 2500°C (4530°F), is easily machined into complex shapes, and is especially suited for applications where the insulation panels need to provide structural support or bear weight.

GRAFSHIELD heat management solutions include GRI, GRIG, GRAF



BOARD and AMW compact, lightweight, and durable products that effectively manage radiant, conductive, and convective heat transfer, increasing furnace efficiency and operational profitability. GRI and GRIG products are carbon-bonded carbon fiber rigid insulations with low thermal conductivities. They withstand furnace temperatures of up to 5400°F (3000°C) and are significantly more cost effective than metallic radiation shields. Their low density means a much lower thermal mass to heat up resulting in very low power draws to reach equilibrium operation temperature. And, because graphite cools rapidly, more run-cycles are possible every day. Unlike rolled felt insulation, GrafTech's rigid insulations do not suffer voids or hot spots, nor do they distort when subjected to rapid changes in

Graphite products provide increased furnace efficiency and operational profitability.

pressure and temperature. Their rigidity makes them easy to handle, easy to install, easy to repair and easy to clean.

GrafTech offers the largest sizes of rigid insulation and carbon foam monolithic blocks in the market. Multipiece board stock and hollow or solid cylinders can be fabricated in larger sizes by the machined "shiplap" joint techniques. When bonded with UCAR grade graphite cement and cured, the joints are stronger than the original insulation and will not lose joint integrity in normal operations. www.graftech.com.