TECHNOLOGY INVESTMENTS KEY TO PM'S FUTURE

Peter K. Johnson*

While the PM industry may be struggling because of the sagging economy and plunging vehicle production in North America, companies are still investing in new technology. When the marketplace returns to health, these investments in the development of new metal powders, equipment, and parts fabrication will reap rewards.

METAL POWDER DEVELOPMENTS

Hoeganaes Corporation, Cinnaminson, New Jersey, has developed several new powder products, reports K.S. (Sim) Narasimhan, vice president and chief technology officer. Ancorsteel 30 HP offers PM parts makers a way of reducing costs by replacing higher-molybdenum-containing prealloys with a lower-molybdenum-containing grade, especially in the quench-and-tempered condition. A lower-cost sinter-hardening grade, Ancorsteel 721 SH, is now available for sinter hardening or heat treating. Densities approaching 7.55 g/cm^3 by single pressing and sintering at 1,200°C (2,190°F) can be achieved with Ancordense 450, an improvement over Ancormax 200. Ancorsteel AMH is a low-apparent-density atomized powder that can replace sponge iron powder for PM parts. Examples of the compaction response of these powders are illustrated in Figure 1. Additional new powders include Ancorlam for electronic applications, and nickel-free steel powder.

Ian Howe, director of application and product development, North American Höganäs, Inc. (NAH), Hollsopple, Pennsylvania, says his company is focusing on cost-effective alloys, improved machinability additives, enhanced bonded mixes, and a warm-die-compaction lubricant system.

Some cost-effective NAH alloys include lean-chromium-containing materials such as Astaloy CrM and Astaloy CrL, as well as new materials Astaloy LH and D.L.H. In addition, the company introduced CMN, a lean

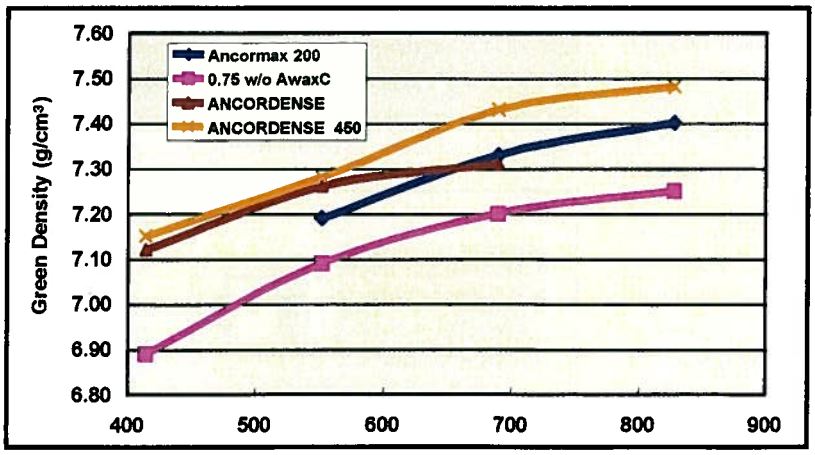

Figure 1. Compaction response of new ferrous powders. Base mix FL 4400 (0.35 w/o graphite)

**Contributing Editor*, International Journal of Powder Metallurgy, *APMI International, 105 College Road East, Princeton, New Jersey 08501-6692, USA; E-mail: pjohnson@mpif.org.*

alloy for PM parts requiring heat treatment to develop properties. In 2008 NAH developed machining additives to greatly improve machinability relative to MnS for pearlitic structures (HRB <75), and for martensitic structures (>HRC 35). Focusing on increasing green densities, the company launched Intralube E, a new lubricant for warm-die compaction for applications in the green-density range of 7.20–7.35 g/cm^3.

A new prototyping center incorporates CAD/FEA and compacting presses including an 800 mt (881 st) hydraulic press. Sintering and heat treating, and CNC machining, are also available for producing prototype parts.

Rio Tinto's powder plant (formerly Quebec Metal Powders Ltd.), Sorel-Tracy, Québec, Canada, is concentrating R&D on lower-cost alternative materials to replace diffusion-bonded powders and high-nickel-containing grades, reports Francois Chagnon, principal scientist, technology center. This will be achieved through new organic bonded powders and by redesigning alloys and/or mix formulations with elements that are less sensitive to price volatility. Reaching a density of 7.5 g/cm^3 with single pressing and sintering is a very important goal for the PM industry. This will be achieved by developing high-compressibility powders and redesigning compacting presses and tooling to attain pressures up to 1,100 MPa (80 tsi).

Carpenter Powder Products Inc., Bridgeville, Pennsylvania, is developing improved powder-making and processing procedures to provide cleaner prealloyed iron, nickel, and cobalt-based powders for high-performance parts, says Louis W. Lherbier, director of technical market development. The company has also increased its capacity to produce metal injection molding (MIM) powders by acquiring Ultrafine Metals Powders. It sees increased demand for stainless steel, nickel, and cobalt-based alloys for hot isostatic pressing (HIPing). Among future trends, Carpenter sees the increasing use of laser technology to make free-form near-net-shape parts from specialty alloy powders.

Edul Daver, president of ACuPowder International, LLC, Union, New Jersey, reports on nonferrous powder trends. Extra-fine spherical copper powders are finding applications in electronics. Specialty bronze powders, which have high strength and high hardness, are being used to make bronze structural parts.

Magnesium Elektron Powders, Manchester, New Jersey, will complete an expansion of its Hart Metals facility in Tamaqua, Pennsylvania, says Deepak Madan, vice president of technology & new product development. The investment will increase the company's total magnesium atomization capacity by more than 150 percent, Figure 2.

EQUIPMENT INNOVATIONS

Uwe Haupt, sales representative at ARBURG GmbH + Co KG, Lossburg, Germany, cites the Allrounder A series injection molding machines with electrically driven motion axes for achieving up to 50 percent in energy savings in producing MIM parts, Figure 3.

Dorst will continue investing in new compacting equipment that improves the performance and productivity of PM parts manufacturing, says Greg Wallis, CEO of Dorst America, Inc., Bethlehem, Pennsylvania. Capable and reliable equipment supported both locally and remotely will be in demand, as PM parts makers will not be able to meet higher-performance requirements demanded by customers with outdated equipment.

Ingo Cremer, Cremer Thermoprozessanlagen GmbH, Düren, Germany, cites a growing demand for sintering at up to 1,200°C (2,190°F). The company has designed a range of conveyor furnaces that can use conventional belts at up to 1,200°C (2,190°F), which can generate significant savings.

Elnik Systems, Div. of PVA MIMtech, LLC, Cedar Grove, New Jersey, offers a new furnace, Figure 4,

Figure 2. Expanded magnesium atomizing plant

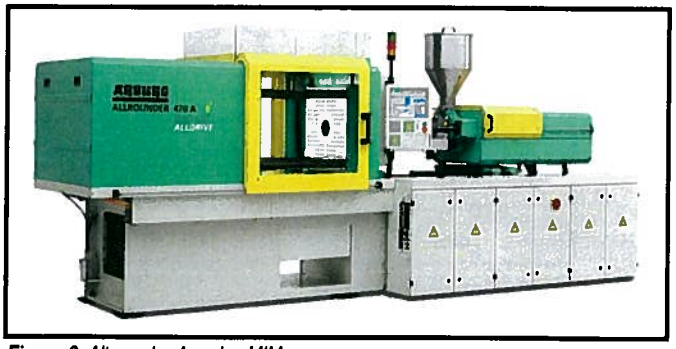

Figure 3. Allrounder A series MIM presses save energy

for debinding the secondary binder in sintering MIM parts, reports Claus J. Joens, president. Debinding is achieved using a plasma at 1 to 7 mbar pressure and sintering with a laminar gas flow at 400 mbar.

Impco, Inc., East Providence, Rhode Island, has improved PM impregnation technology substantially through a combination of material and process developments, reports Terry Chwalk, vice president. These improvements include improved pore filling, which results in higher-quality plating and more-consistent machining of PM parts.

Minox-Elcan Industries, Inc., Mamaroneck, New York, offers Kroosh multi-frequency vibratory screeners, Figure 5, capable of screening particulate materials with efficiencies of more than 95 percent, reports Bob Grotto, president. These machines have increased throughputs by a factor of 15 to 20 over conventional screeners, the company reports.

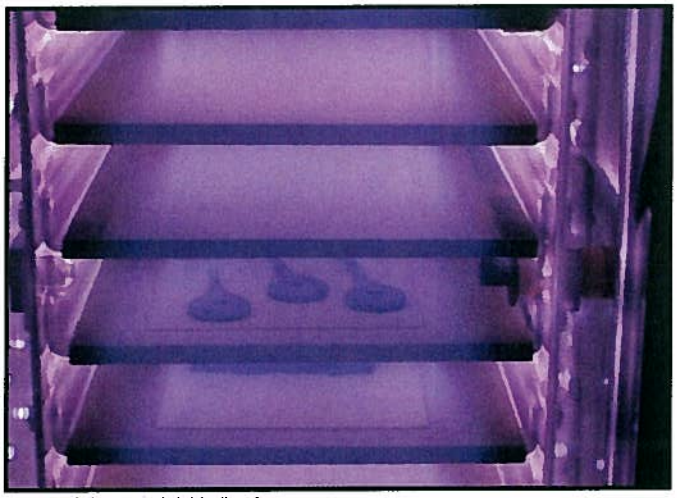

Figure 4. Improved debinding furnace

Figure 5. Multi-frequency vibratory screeners increase productivity

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Expanding the Possibilities For Size Reduction

Dave Quilter, manager of refractory systems, Pyrotek, Inc., Canastota, New York, reports that refractory castables, shape-casting techniques, mold making, and curing processing improvements have significantly impacted the cost effectiveness of refractory shapes. Blending traditional brick and cast-in-place techniques with precast technology has provided an enhanced finely tuned rebuild package. Rebuilding a high-temperature pusher furnace with all precast cured refractory shapes can cut 75 percent of the labor hours needed to rebuild a traditional brick design.

UTRON Kinetics, UTRON, Inc., Manassas, Virginia, has developed the combustion-driven compaction (CDC) process for making high-density PM and ceramic parts with improved properties, says Dennis Massey, CEO. The company has successfully made cost-effective parts for defense applications. The CDC process uses the energy generated from the controlled combustion of a refined-gas-and-air mixture to power press motions, Figure 6. The energy source can generate extreme forces >91 $\times 10^4$ mt (10^6 st) and more moderate forces of 91 to 2,723 mt (100 to 3,000 st). When combined with powder and lubricant developments, the process can attain full or near-full density with a single stroke, the company claims. This is achieved through incorporating press stroke speed, impact control, and tooling preloading not attainable with current mechanical and hydraulic compacting presses. Tooling can withstand a 100-to-200 percent increase in applied compaction pressure without failure.

PM PARTS TRENDS

C. L. Chu, general manager, Porite Taiwan Co.,

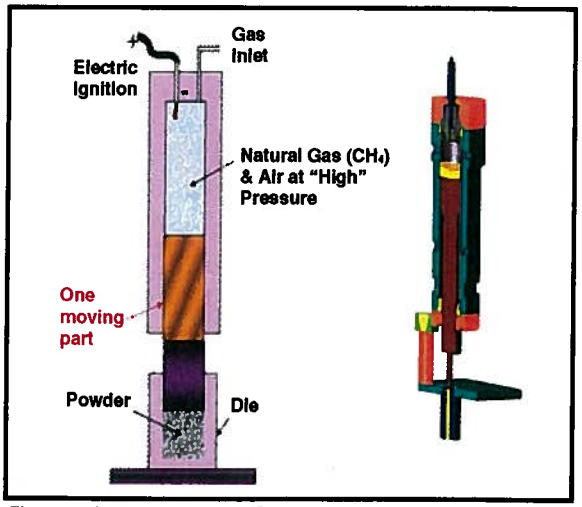

Figure 6. CDC press concept

Figure 7. Complex high-speed tool steel applications

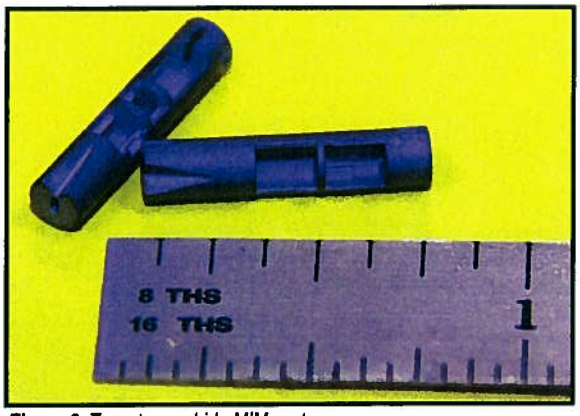

Figure 8. Tungsten carbide MIM part

Ltd., Taiwan, reports on new projects developing high-nickel and high-chromium alloys for electronics and energy applications. New automotive VVT/VCT and high-pressure pumps have passed validation tests and Porite intends to supply more automotive parts to the U.S. and Europe. In addition, the company is leveraging its 13 years of warm compaction experience for higher-density compaction.

PSM Industries, Los Angeles, California, is using PM techniques to create new engineered materials for applications requiring extreme wear resistance and toughness, reports Craig Paullin, president. Capturing net or near-net shape lowers manufacturing costs. The company is working with powder suppliers to provide more compressible materials in alloy-rich compositions. Its PM Krupp division uses a proprietary sintering process to make fully dense high-speed tool steels in complex shapes with hardness up to HRC 67, Figure 7. The Ferro-Tic division supplies steel-bonded titanium carbide which PSM says is 50 percent harder than tungsten carbide. PSM's Yillik Precision Carbide division has recently developed a material containing tungsten carbide and titanium carbide sub-micron particles in a cobalt/nickel base. Yillik and the PolyAlloys division are applying MIM technology to make complex fully dense tungsten carbide parts, Figure 8. ijpm

Global Titanium Inc.

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Global Titanium Inc.
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