

# NEWS

For Release on  
May 20, 2011  
San Francisco, CA  
# 3



## METAL POWDER INDUSTRIES FEDERATION

105 COLLEGE ROAD EAST  
PRINCETON, NEW JERSEY 08540-6692 USA

TEL: (609) 452-7700

FAX: (609) 987-8523

E-MAIL: [info@mpif.org](mailto:info@mpif.org)

WEB SITE: [www.mpif.org](http://www.mpif.org)

### Award Winning Powder Metallurgy Parts

Design innovation, superior engineering properties, high end-market visibility, and sustainability distinguish the winners of the 2011 Design Excellence awards, the annual powder metallurgy (PM) design competition sponsored by the Metal Powder Industries Federation. The PM process demonstrates unique value propositions over competing forming processes such as investment casting, die casting, deep drawing, machining, stamping, and fine blanking. PM's stellar design performance is underscored in automotive engines, emergency breathing units, audio devices, security locks, endoscopic surgical devices, hand tools, recreational products, industrial refrigeration equipment and pumps, railway brake systems, and rifle sights.

### Grand Prize Awards

GKN Sinter Metals, LLC, Auburn Hills, Mich., earned the grand prize in the automotive transmission category for a carrier and one-way rocker clutch assembly made for Ford Motor Company. Used in the new Ford Super Duty TorqShift six-speed automatic transmission, the hybrid assembly contains five PM steel parts weighing a total of 17 pounds. The sinter-brazed subassembly consists of four multi-level PM parts, of which three parts (cage, spider, and carrier plate) are made to a density of  $6.8 \text{ g/cm}^3$ . The rocker plate is sinter-hardened during the sinter-brazing phase and has a density of  $7.0 \text{ g/cm}^3$ . The assembly also has a doubled-pressed and double-sintered cam plate made to  $7.3 \text{ g/cm}^3$  density with an ultimate tensile strength of 170,000 psi and a mean tempered hardness exceeding 40 HRC. To form the parts and maintain precision tolerances, innovative tooling was developed and used in conjunction with unconventional press motions. Ford subjected the assembly to stringent durability testing—ultimate torsional torque loading at a minimum of 8,000 foot-pounds and fatigue testing at a minimum of 299,000 cycles at 1,730 foot-pounds. The application provided an estimated 20% cost savings over competitive processes, and represents a new era in the scope and size of PM parts. “Designed for PM,” the assembly uses fewer components compared to alternate designs and manufacturing methods, reducing the mass of the assembly, thus improving fuel efficiency without sacrificing function or performance.

GKN Sinter Metals, LLC, Auburn Hills, Mich., won another grand prize in the automotive chassis category for a differential bearing adjuster made for its customer American Axle & Manufacturing and used in the GMT 900 rear differential on GM Tahoe and Yukon models. The diffusion-alloyed PM steel part preloads the bearing and is locked in place through the side holes. Formed to a density of  $6.8 \text{ g/cm}^3$ , it has a 155,000 psi transverse rupture strength, 79,000 psi tensile strength, yield strength of 63,000 psi, and 90 HRB apparent hardness. A special die and dual-upper-punch design form the cross-holes during compaction. Selecting PM saved the customer \$320,000 annually by replacing a casting that required extensive machining.

*Advancing Powder Metallurgy  
& Particulate Materials Worldwide*

A FEDERATION OF THESE TRADE ASSOCIATIONS:

POWDER METALLURGY PARTS ASSOCIATION  
METAL POWDER PRODUCERS ASSOCIATION  
POWDER METALLURGY EQUIPMENT ASSOCIATION  
METAL INJECTION MOLDING ASSOCIATION  
REFRACTORY METALS ASSOCIATION  
ISOSTATIC PRESSING ASSOCIATION

A porous bronze filter made by Capstan California, Carson, Calif. for Chase Filters and Components received the grand prize in the aerospace/military category. Gravity sintered, the filter is used in an ignition-resistant, fault-tolerant oxygen cryopac filter for medical and emergency breathing systems. The filter's fluted design increases surface area, which in turn increases flow and dirt-holding capacity. The innovative design of the sintering mold allows the retention groove to be formed in the part, eliminating secondary operations. The PM bronze filter replaced a more costly and less reliable stainless steel filter.

Parmatech Corporation, Petaluma, Calif., earned the grand prize in the hand tools/recreation category for a large-game 420 stainless steel hunting arrowhead, the 300Xtreem broadhead, made for Optek Precision Tooling Ltd. Fabricated by the metal injection molding (MIM) process, the thin blade features a critical straightness necessary for accuracy and the external thread for attachment to the arrow shaft is molded in the design. The part is formed to a final density of  $7.7 \text{ g/cm}^3$  and has a 48–52 HRC hardness range. Going the metal injection molding route saved 50% of the cost of machining the broadhead from stainless steel bar. The customer sharpens the arrow head edge, the only secondary operation performed.

A PM copper–steel outer hub exit spindle used in electronic door locks won the grand prize in the hardware/appliances category. Made by ASCO Sintering Company, Commerce, Calif., for Ingersoll Rand Security Technologies (Schlage), the part connects a standard lock and an exit device. When activated through a code or electronic card reader, the spindle rotates to the standard lock assembly. The PM spindle is made to a  $7.7 \text{ g/cm}^3$  density and has a 95,000 psi ultimate tensile strength, 8 percent elongation, and 90 HRB hardness. The PM process allowed 95% materials utilization as opposed to machining a wrought blank which yields a materials utilization figure of only 45%. PM also provided a 90% energy savings.

FloMet LLC, Deland, Fla., earned the grand prize in the medical/dental category for a housing cup and lid used in an audio device with magnetic shielding capabilities. This application is the first of its kind in the high-power audio device sector. The anti-magnetic MIM material with high nickel content provides electromagnetic interference, or EMI shielding, preventing interference from other electronic signal sources. While the cup has four thin walls for proper assembly, the new lid design must fit securely into the cup opening; this prevents moisture and/or foreign matter from entering the housing, as well as maintaining the EMI shielding capability. Manufactured to  $8.30 \text{ g/cm}^3$  density, the parts have an ultimate tensile strength of 84,000 psi, yield strength of 32,000 psi, and a 40% elongation. Alternative manufacturing processes such as deep drawing, casting, and machining would have required multiple components. Combining these multiple components through the MIM process provided significant cost savings, in addition to eliminating up to 40% scrap loss.

## Awards of Distinction

Cloyes Gear & Products, Inc., Paris, Ark.. won the award of distinction in the automotive engine market category for an intake sprocket gear and an exhaust gear used in a coupling assembly operating in 2.0 and 2.2 liter diesel engines made by General Motors Korea. The gears receive torque from the timing chain, which drives the intake camshaft and transmits torque to the exhaust camshaft. The exhaust gear, also called a “scissor gear,” is an anti-backlash gear, which reduces backlash and mediates engine noise, vibration, and harshness. Warm compacted to a  $7.2 \text{ g/cm}^3$  minimum density on the teeth, the PM steel gears have an ultimate tensile strength of 196,000 psi, typical yield strength of 161,000 psi, a fatigue limit of 55,000 psi, and 74 HRA hardness after carburizing. The gear teeth are shaved to achieve an AGMA 9 rating. PM’s highly efficient materials utilization clearly demonstrates its sustainability benefits. The more traditional fabrication method for diesel engine parts—machined wrought steel gears—would have required 8.5 pounds of additional material to be machined away.

A rear sight used on sporting and military rifles such as the AR-15, M4, and M16 models, received the award of distinction in the aerospace/military market category. Made by Megamet Solid Metals, Inc., Earth City, Mo., for its customer, Yankee Hill Machine Co., Inc, the nickel steel MIM part features very close tolerances and a complex geometry requiring an elaborate tool design. The sight allows the shooter to target objects at ranges up to 200 yards by using the larger aperture, and to target objects at longer ranges by flipping the sight down and using the smaller aperture. The part is made to a density of  $7.5 \text{ g/cm}^3$  and has an as-sintered ultimate tensile strength of 55,000 psi. Choosing the MIM process over investment casting provides a 40% cost savings. Secondary operations are limited to tapping and nitride finishing.

Indo-US MIM Tec (P) Ltd., Bangalore, India, won an award of distinction in the hand tools/recreation market category for a 17-4PH stainless steel hammer used in a Leatherman Tool Group multi-purpose military utility tool (MUT) designed for military and law enforcement personnel, and civilians. Made by the MIM process, the intricate complex part performs five of the MUT’s 27 functions. It is formed to a density of  $7.5 \text{ g/cm}^3$  and has an ultimate tensile strength of 175,000 psi, yield strength of 158,000 psi, heat-treated 35–40 HRC hardness, and a minimum six percent elongation. Secondary operations include threading two tapped holes, age hardening and glass-bead blasting, and an optional blackening treatment performed by Leatherman.

Webster-Hoff Corporation, Glendale Heights, Ill., and customer ACCO Brand Inc. received the second award of distinction in the hand tools/recreation market category for a PM sinter-hardened steel cam and bushing used in a manual paper hole punching machine. The cam transfers power to the cutters and the bushing supports the shaft. Both parts are formed to a density of  $6.7 \text{ g/cm}^3$  and have an ultimate tensile strength of 120,000 psi and 27 HRC apparent hardness. Formed to a net shape, the parts are sinter-hardened and tempered. The cam receives a vibro finishing operation and vacuum oil treatment. The customer gained an annual cost savings of \$410,000 by selecting the PM process over machining.

A PM diffusion-alloyed steel rotor made by Lovejoy Sintered Solutions, LLC, Downers Grove, Ill., won the award of distinction in the industrial motors, controls & hydraulics category. The rotor operates in an industrial rotary gear pump for handling fluids like waste water or chemicals. Fabricated to a density of 6.95 g/cm<sup>3</sup>, the rotor has a tensile strength of 105,000 psi, yield strength of 55,000, and 89 HRB hardness. The part must pass a crush test on the tooth–hub joint and have a break strength exceeding 6,000 pounds. Secondary operations include turning, milling, and resin impregnation for preventing leaks and improving machinability. PM provided a cost savings estimated at 22 percent over alternative processes such as machining rolled bar or casting.

Burgess-Norton Mfg. Co., Geneva, Ill., earned the award of distinction in the hardware/appliances category for a PM steel crimp retainer operating in a valve assembly that regulates gas flow in a high-performance compressor for commercial refrigerators. Formed to a minimum density of 7.1 g/cm<sup>3</sup>, the part has a minimum ultimate tensile strength of 160,000 psi, yield strength of 150,000 psi, and 74 HRA hardness. The part's outside diameter is designed with a smooth flowing radius to permit gas flow around it with minimal turbulence. Secondary finishing operations include soft machining of three gas holes in the counter bore, carburizing, quenching, tempering, and hard turning to form the counter bore diameter and face. Picking PM offered a 30 to 50% cost savings over competing fabricating processes such as casting or stamping.

A 17-PH stainless steel distal channel retainer formed via the MIM process by Kinetics Climax Inc., Wilsonville, Ore., received the award of distinction in the medical/dental market category. The complex, multi-level part is the main distal-side component of an articulation joint in an articulating mechanical stapler/cutter used in endoscopic surgery. Formed to a typical density of 7.7 g/cm<sup>3</sup>, the part has a typical tensile strength of 175,000 psi, yield strength of 158,000 psi, and a six percent elongation. The MIM process provided a cost savings in the range of 25 to 30% vs. other design options. Kinetics performs precision sizing and reaming.

A bronze filter plate made by Capstan California, Carson, Calif., for Knorr-Bremse GmbH in Austria won an award of distinction in the off-highway category. Made via the gravity sintering process, the net-shape part is used in the braking system of European commuter trains. A highly innovative graphite mold design incorporates the 8.2 mm cross-hole, which eliminates a machining operation for drilling the hole. The burr-free design required 8.8% less material than the competitive process and reduced the cost of the part by 27%.

The awards were presented here during the 2011 International Conference on Powder Metallurgy & Particulate (PowderMet2011).

# # #

**Editor's note:** For further details contact James Dale at MPIF (609-452-7700 / [jdale@mpif.org](mailto:jdale@mpif.org)). Digital photos available contact [dschember@mpif.org](mailto:dschember@mpif.org).

# MPIF 2011 Powder Metallurgy Design Excellence Award Winners



## 2011 Grand Prize Winners

Foreground: Outer hub exit spindle and audio housing cup & lid  
Middle row: Archery broadhead, bronze filter, and differential bearing adjuster  
Third row: Carrier & rocker assembly



## 2011 Award of Distinction Winners

Front row: MUT hammer, rear sight, and distal channel retainer  
Second row: Crimp retainer, sintered plate, and cam & bushing  
Back row: Coupling assembly gears and pump rotor

Digital Images Available Upon Request  
Metal Powder Industries Federation, 105 College Road East, Princeton, NJ 08540-6692  
609-452-7700 dschember@mpif.org

# 2011 MPIF Design Excellence Awards Grand Prize Winners



**Automotive: Transmission**  
Carrier & Rocker Assembly



**Automotive: Chassis**  
Differential Bearing Adjuster



**Hand Tools/Recreation**  
Broadhead Arrow Tip



**Aerospace/Military**  
Bronze Cryopac Filter



**Hardware/Appliance**  
Electronic Lock Outer Hub Exit Spindle



**Medical/Dental**  
Audio Device Housing Cup & Lid

Digital Images Available Upon Request  
Metal Powder Industries Federation, 105 College Road East, Princeton, NJ 08540-6692  
609-452-7700 dschember@mpif.org

# 2011 MPIF Design Excellence Award of Distinction Winners

## Automotive: Engine



Coupling Assembly Gears

## Aerospace/Military



Rifle Rear Sight

## Hardware/Appliances



Valve Crimp Retainer

## Off-Highway



Braking System Filter Plate

## Hand Tools/Recreation



Military Utility Tool Hammer

## Industrial Motors/ Controls & Hydraulics



Hole Punch Cam & Bushing



Industrial Pump Rotor

## Medical/Dental



Distal Channel Retainer

Digital Images Available Upon Request

Metal Powder Industries Federation, 105 College Road East, Princeton, NJ 08540-6692

609-452-7700 dschember@mpif.org