

PM Design Winners

ANNOUNCED AT POWDERMET2011



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 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.

Presented during the 2011 International Conference on Powder Metallurgy and Particulate (PowderMet2011), GKN Sinter Metals, LLC, located in Auburn Hills, Michigan, 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 g/cm³. The rocker plate is sinter-hardened during the sinter-brazing phase and has a density of 7.0 g/cm³. The assembly also has a double-

pressed and double-sintered cam plate made to 7.3 g/cm³ 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 percent 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 won another grand prize in the automotive chassis category for a differential bearing adjuster made for its customer American Axle and 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 g/cm³, 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.

A porous bronze filter made by Capstan California, located in Carson, 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.

Parmatech Corporation, located in Petaluma, California, 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.

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, located in Commerce, California, 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.

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.

A PM diffusion-alloyed steel rotor made by Lovejoy Sintered Solutions, LLC, in Downers Grove, Illinois won the award of distinction in the industrial motors, controls and 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/cm³, the rotor has a tensile strength of 105,000 psi, yield strength of 55,000, and 89 HRB hardness.

Burgess-Norton Mfg. Co., Geneva, Illinois, 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.

A 17-PH stainless steel distal channel retainer formed via the MIM process by Kinetics Climax Inc., located in Wilsonville, Oregon, 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.

A bronze filter plate made by Capstan California, Carson, California., 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.

Cloyes Gear and Products, Inc., located in Paris, Arkansas, 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.

A rear sight used on sporting and military rifles such as the AR-15, M-4, and M-16 models, received the award of distinction in the aerospace/military market category. Made by Megamet Solid Metals, Inc., located in Earth City, Missouri, 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.

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 g/cm³ 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, located in Glendale Heights, Illinois, 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 g/cm³ and have an ultimate tensile strength of 120,000 psi and 27 HRC apparent hardness.

For more information on PowderMet2011, visit www.mpif.org.