OUTSTANDING POWDER METALLURGY PARTS

GRAND PRIZE WINNERS

AUTOMOTIVE ENGINE STATOR

PMG Füssen GmbH, Füssen, Germany, and its customer Schaeffler Group Automotive, Hirschaid, Germany, won the grand prize in the automotive engine category for a stator in a variable valve timing system in a 1.4 liter engine. Made from a modified iron–copper PM material, the complex part is formed to a density of 7.0 g/cm^3. The stator, featuring five intricate center holes, is a one-piece design that replaced two parts. Very tight tolerances help to minimize any internal oil leakage between the adjoining pressurized chambers. The stator helps reduce fuel consumption and the formation of exhaust gases, as well as improving engine performance, especially torque at low rpms. It has two functions: a spline for the timing-belt pulley and the VVT housing. The PM process offered substantial cost savings despite finishing operations such as sizing, machining, deburring, and steam treating.
www.pmgsinter.com

BACKING PLATE

Burgess-Norton Mfg. Company, Geneva, Ill., and its customer, Means Industries, Saginaw, Mich., won the grand prize in the automotive transmission category for a notch/backing plate and a pocket plate in a mechanical diode one-way clutch for a six-speed automatic transmission. Made from sintered-hardened PM steel, the notch/backing plate weighs 1.85 pounds and the pocket plate 2.54 pounds. The plates are assembled with steel struts, coil springs, and a snap ring, which form the one-way clutch. Both parts are made to a density of 6.7 g/cm^3. The notch/backing plate has a tensile strength of 75,000 psi, and the pocket plate a tensile strength of 90,000 psi. Powder metallurgy provided superior precision and a 70% cost savings over wrought steel parts. Both parts are vital to the clutch design by permitting drive torque to be applied to the transmission in second and sixth gear, as well as torque transfer in reverse gear.
www.burgessnorton.com

AWARDS OF DISTINCTION

ENGINE SPROCKETS

Cloyes Gear & Products Inc., Paris, Ark., received the award of distinction in the automotive engine category for PM low-alloy steel intake and exhaust sprockets in a variable valve timing system in a high-performance, double-overhead cam V-6 engine. The sprockets are formed via warm compaction to a density of 7.25 g/cm^3. The 7.7 millimeter fine-pitch inverted sprocket teeth are compacted to a near-net shape. The complex design is a multifunction part, a high-strength timing sprocket that does cam phasing functions. The teeth are heat treated and tempered to a 70 HRA typical hardness. Each sprocket has a typical tensile strength of 170,000 psi, a 52,000 psi fatigue limit, and compressive yield strength of 183,000 psi.
www.cloyes.com

STAINLESS STEEL BOBBINS

ASCO Sintering Co., Commerce, Calif., and its customer Performance Friction Corp., Clover, S.C., won the award of distinction in the automotive chassis category for a series of 316 stainless steel bobbins in a new braking system for race cars and high-performance vehicles. The two-level part is available in 14 variations with eight or more bobbins in a single brake rotor assembly. The bobbins aid in tripling the brake-rotor fatigue life, reducing drag at elevated temperatures, as well as reducing vibration and temperature. The parts are made to a density of 7.0 g/cm^3 and have a tensile strength of 70,000 psi, yield strength of 45,000 psi, a 13% elongation, 48-foot-pound impact strength, and HRB 65 hardness. www.ascosintering.com

HIGH-STRENGTH GEAR SET

Mitsubishi Materials PMG Corp., Tokyo, Japan, and its customer Fuji Kiko Co. Ltd., Shizuoka, Japan, won the grand prize in the automotive chassis category for a high-strength gear set used in a new tilting and telescoping steering column. The gear set consists of a tooth lock and two cams. Made from diffusion-alloyed PM steel, the parts have a density greater than 7.05 g/cm^3 and a tensile strength greater than 159,000 psi and a 57 HRA hardness. In replacing forged and machined parts, PM offered substantial cost savings with a net-shape design that eliminated the need for machining.
www.pmgsinter.com

PRINTER GEAR SET

Capstan Atlantic, Wrentham, Mass., captured the grand prize in the hardware/appliances category for a PM steel gear set in a high-volume business machine printer. The gear is roll-densified to a surface density of 7.8 g/cm^3. It has an AGMA quality 10 precision level and the pinion has an AGMA 8 level. The core density of the gear and pinion is 7.3 g/cm^3. The gear-tooth-surface fatigue resistance equals that of a wrought steel 8620 carburized gear. The part, which has opposing helix angles, is formed to net shape, except for hard turning the datum journals. Single pressed, the PM gear replaced two machined gears at a cost savings of more than 40%.
www.capstanatlantic.com

ARTICULATION GEAR

Parmatech Corp., Petaluma, Calif., won the grand prize in the medical/dental category for a 17-4 PH stainless steel articulation gear in a surgical stapling unit. Made by metal injection molding to a density of more than 7.65 g/cm^3, the MIM part has an ultimate tensile strength of 130,000 psi, yield strength of 106,000 psi, and a 25 HRC hardness. The complex MIM design is formed to net shape and requires no finishing operations. It has tight tolerances and provided a 70% cost savings compared to machining the gear from bar stock.
www.parmatech.com

This article shows the winners of the 2008 Powder Metallurgy Design Excellence Awards Competition, sponsored by the Metal Powder Industries Federation. Nine winning parts are shown, including grand prizes and awards of distinction.

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STAINLESS STEEL LOCK PARTS

Kinetics Climax Inc., Wilsonville, Ore., won the award of distinction in the hardware/appliances category for three 17-4 PH stainless steel lock-cylinder parts made by metal injection molding for Black & Decker Hardware and Home Improvement, Lake Forest, California. The MIM parts (a locking bar, pin, and rack) operate in the Kwikset SmartKey lock cylinder, which contains one locking bar, five pins and five racks. The high-precision parts have a typical density of 7.7 g/cm^3, and a typical tensile strength of 128,000 psi and typical yield strength of 100,000 psi. The complex PM design provides significant cost savings and allows the consumer to re-key the lock easily, without removing it or getting professional help.
www.kinetics.com

HEARING AID RECEIVER CAN

FloMet LLC, Deland, Fla., and its customer, Starkey Laboratories Inc., Eden Prairie, Minn., won the award of distinction in the electrical/electronic components category for a hearing aid receiver can made by metal injection molding. The thin-walled part is made of a nickel-iron-molybdenum alloy that provides the magnetic shunt effect required in the hearing aid to separate the internal receiver signal from the telecoil signal. The MIM part was previously deep drawn and required several interim annealing steps to achieve the necessary depth, in addition to forming the internal undercuts. Choosing the MIM manufacturing process provided a 50% cost savings over deep drawing, as well as improved performance. www.flomet.com