This booklet contains all of the entries into the 2010 EPMA Awards for Innovation in Powder Metallurgy.

The booklet also contains the winning entries from both the MPIF and JPMA annual awards.
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Introduction

The EPMA has organised its annual prestigious Awards for Excellence in Powder Metallurgy to coincide with the World PM2010 International Conference here in Florence.

Awards in the following categories will be presented in the plenary session:
- Components
- Materials & Equipment
- International

In all cases, a panel of independent experts drawn from across Europe, using the following criteria, refereed the entries:

- To what extent is the PM component/material/process described in the entry expected to provide cost savings and/or improved quality?
- To what extent is the entry expected to stimulate further usage of PM technology in the area of applications covered?
- How well is the entry prepared (description of component/material/equipment etc., inclusion of diagrams, photographs and other illustrations)?
- How do you rate this application in terms of excellence in exploiting PM OR How do you rate this application in terms of novelty: surpassing borders of bringing new ideas into practice?

This booklet contains details of all the entries for this year’s competition, which will be on display on the PM Showcase at World PM2010. The EPMA wishes to congratulate and thank all its member companies who entered the competition.

Further information on this year’s award entries can also be found on the EPMA website - www.epma.com/awards2010 which will be available late 2010.
EPMA Award Entries - Components

SINTERED HUB

Product Density: 6.8 grams/ccm
Product Tensile Strength: 650 MPa
Product Hardness: 85 HRB
Final Weight: 652 grams
Finishing: Sizing, Drilling, Turning

Summary: • Extreme shape complexity almost to netshape
• Difficult and precise machining operations
• The component has been designed directly for the PM process. It is practically impossible to obtain by other technologies.
• This component works under duty compression and wear conditions. This part belongs to an assembly “Compressor Clutch” for brake systems in heavy trucks and buses. The function is to stop the compressor when the pressure of air is sufficient, in order to reach energy savings and consequently less fuel consumption.

DELTA CON ROD

Product Density: 6.8 grams/ccm
Product Tensile Strength: 300
Product Hardness: 65 HB
Final Weight: 8.5
Finishing: Precision Sizing of the two bores, Steam Treatment

Summary: Small Con-Rods for Refrigerators surely are a good example of classic application for PM Technology. The shape and material specification have been well established and in recent years this kind of part became almost a pure commodity.

The weight reduction has been investigated with Finite Element Analysis. The rod between the two bores could be reduced down to 1 mm thickness and due to the triangular shape with triangular bore the torsion and bending deformations are equal to the traditional design.

To optimize the cost aspect the material is SintD11 with an additional steam treatment in a self developed Belt Furnace. This is enough to satisfy the customer’s resistance requests with excellent cost containment.
**HIGH PERFORMANCE POWDER CORE**

**Product Density:** 7.7g/cm³  
**Product Tensile Strength:** 25  
**Product Hardness:** unknown  
**Final Weight:** 15 grams  
**Finishing:** Machining  

**Summary:** Hitachi Powdered Metals and Denso developed composite armature and magnetic powder core (stator) which are installed as magnetic parts in injectors for common rail systems. This common rail system has met exhaust emissions regulation of EUROV, and these are parts that become keys to the injector.

Composite armature consists of the sintered soft magnetic material and the high wear resistance materials, and these are bonded by our company’s original Sinter Diffusion Bonding Method. We have selected Fe-2Si sintering material which has high flux density (1.52T) and high permeability (μ:4000) from demanded magnetic flux density and specific resistivity. For the shaft part, we selected high speed steel (SKH51) to meet the demanded high wear resistance.

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**MIM CASTING TRIPOD**

**Product Density:** 7.65  
**Product Tensile Strength:** 570  
**Product Hardness:** 77HB  
**Final Weight:** 260 grams  
**Finishing:** Machining and Electropolishing  

**Summary:** We manufactured for a company a set of four pieces that compose a stainless steel tripod for cameras. The most impressive part of the set is the tripod casting (body): a 260 g stainless steel, AISI 316, piece.

This austenitic stainless steel was chosen for its excellent corrosion properties being the tripod intended for outdoor corrosion demanding application.

The as-sintered part is then subjected to machining to remove sintering built-in supports, to resize lateral holes and make the thread. The part is then electro polished to reach its final and pre-assembling stage.
LOCKING DEVICE FOR SPECTACLES

**Product Density:** 7.9g/cm³  
**Product Tensile Strength:** 510  
**Product Hardness:** 120 HV10  
**Final Weight:** 0.028 g / 0.046 g depending on version  
**Finishing:** Only tumbling operation is needed  
**Summary:** For this revolutionary and extremely small locking device for spring hinges in spectacles the minimized size is combined with a complex shape due to the huge quantity per year needed - it is produced in a 32 cavity mould.

This component was designed from the beginning as a part made out of metal injection moulding. This component of only 0.028 g needs a high precision which only MIM could guarantee. For a safe locking function the geometry of the part had to be designed with special features.

NECK LINK

**Product Density:** 7.6g/cm³  
**Product Hardness:** core 120 HV1  
**Final Weight:** green weight: 17.52g  
Sintered weight of component: 15.91g  
**Finishing:** The parts do require mechanical secondary operations for the outer diameter 20.8 +/-0.03 and the inner diameter 8H7  
**Summary:** Heine has been producing its Diagnostic Center EN 100 since 1998. It contains among other instruments an otoscope an ophthalmoscope and an extension unit. All instruments use the same holder.

One of the critical components of this holder is the so called automated locking device which originally had been developed and patented some 40 years ago. It allows for one handed opening and closing of the locking mechanism and is still considered an ideal solution for the precise fit of the instruments.
JET PROTECTOR COMPONENTS

Summary: The new JPX™ Jet Protector® is the most functional and powerful hand-held OC delivery system available today. Oleoresin Capsicum (OC) is an extract of the cayenne pepper plant. A patented propulsion system launches high grade OC solution at 430 km/h. Effective range is up to 6.5 meters which makes the JPX extremely effective for law enforcement use.

The Piexon JPX Jet Protector contains 3 different MIM parts from Parmaco, the latch, 2 strikers and the counter plate.

JET PROTECTOR STRIKER

Product Density: 7.8g/cm³
Product Hardness: HV1 600-800, Case depth 0.15+0.1mm
Final Weight: Green weight: 6.87g, Sintered weight of component: 6.20g
Finishing: Case hardening, Tumbling, Nickel plating

JET PROTECTOR COUNTER PLATE

Product Density: 7.8g/cm³
Product Hardness: HV1 600-800
Case depth 0.15+0.1mm
Final Weight: Green weight: 18.42g
Sintered weight of component: 16.66g
Finishing: Taping, Case Hardening, Tumbling, Nickel Plating

JET PROTECTOR LATCH

Product Density: 7.8g/cm³
Product Hardness: HV1 600-800
Case depth 0.15+0.1mm
Final Weight: green weight: 13.88g
Sintered weight of component: 12.58g
Finishing: Taping, Case hardening, Tumbling, Nickel Plating
LOCKING ELEMENT

Product Density: 7.6g/cm³
Product Hardness: core 120 HV1, surface 1000-1050 HV0.05
Final Weight: Green weight: 0.265g
Sintered weight of component: 0.237g
Finishing: the as sintered 316L parts are treated with a unique process called colsterizing which allows 316L to reach a surface hardness of HV0.05 1000-1050 and a penetration depth of 0.03mm

Summary: MIM parts are increasingly used in the lock industry. There is a shift to ever smaller and safer locking systems and consequently to smaller lock components. The Locking Element is a microMIM component which is used in a wireless access system from Simons Voss Technologies.

Critical features of the MicroMIM-Locking Element are:
- Sharp edges in some areas (R < 0.05 mm)
- Burr freeness
- Surface roughness better than Rz16, in some areas better than Rz 10
- 316L material (Hardness 120 HV1) but surface hardness of > 1000 HV0.05
- Life time > 150’000 locking cycles

SYNCHRONIZER HUB

Product Density: max 6.9 g/cm³
Product Tensile Strength: 820MPa
Product Hardness: min 330 HV5
Final Weight: 720g
Finishing: Annealing, Machining, Brushing
Summary: This part is unusually large as compared to typical synchronizer hubs. This part is manufactured for high torque application using a simple press and sinter process without secondary hardening (sinter hardening material) and very little machining.

Conventional synchronizer hubs have their splines broached; this expensive process step is not needed with Powder Metal technology.
AUSSENRING (OUTER RING)

**Product Density:** max 6.9 g/cm³

**Product Tensile Strength:** approximately 1050 N/mm²

**Product Hardness:** 700 + 200 HV 0.2

**Final Weight:** 0.079 kg

**Finishing:** no further finishing required

**Summary:** The “Aussenring” is a complex shaped high-strength part. The biggest challenge was the tolerance of the inner radii of 50µm. The Schunk ES®-sintering had minimum distortion compared to other heat-treatment methods and was instrumental in achieving the required accuracy. The Schunk ES®-processed material withstands the high-hertz's pressure applied by 3 needle bearing pins via internal part. Transport torque is about 20Nm, misuse torque approx. 100Nm, without significant deformation. The background to this development is the need for compact seat adjusters. Due to different patents, TIER 1 suppliers have to find new geometries for their systems. This leads to ever more new designs. At the same time new generations need to be improved, eg. become lighter, more compact, display higher stiffness, be quieter. The applied part reflects the fulfillment of those requirements.

SENSOR HOUSING

**Product Density:** 7.5

**Product Hardness:** 400 - 500 HV

**Final Weight:** 10g

**Finishing:** Machining, Hardening, Coating

**Summary:** Produced only by MIM and in order to stabilize the bushing during debinding and sintering, a bottom is injected. At the same time, the wall thickness is partially increased in order to fasten the three clips and to allow the injection of a wall strength of <0.8mm in the rest of the part.

After sintering, the bottom is removed in an operation and the clips are uncovered by boring out the inside. The base is designed in such a manner that the collar area of the bushing is exposed during debinding and sintering in order to achieve a visually flawless surface.
ALUMINIUM VCT SPROCKET AND ROTOR

Product Density: 2.65
Product Tensile Strength: 300
Product Hardness: 700 + 200
HV 0.2
Final Weight: 220g
Finishing: Sizing, Tempering, Machining

Summary: The rotor and sprocket are used in an automotive cam-phaser application and are the first known such components being manufactured from aluminium powder metal in large scale production.

Using aluminium metal powder combines the benefits from standard sintered iron components (like near net shape capability) with the advantages of lightweight materials: compared to a standard sintered iron cam-phaser design, weight is reduced from 900 grams to 450 grams. Additionally to gasoline saving due to reduced weight, rotating inertia is reduced as well, improving dynamic response behaviour of the cam-phaser, thus giving another benefit to engine performance and efficiency.

TITANIUM POROUS SMALL BUBBLES DISH AERATORS

Product Density: 2.25 g/cm³
Final Weight: 0.2kg

Summary: The manufacture technology (pressing through the elastic cover from polyurethane) allows attaining porous disks with the same porosity on the whole item volume, and it allows generating bubbles of the set sizes along the whole aerator area. Nanosized titanium dioxide particles formation takes place on the porous material surface in the result of the thermal treatment in the sintering process. And that gives the bactericidal properties to the porous material and prevents its biogrowth.

Purpose: dispersion of air, ozone, oxygen and other technological gases in contact chambers for drinking and drainage water ozonizing, in oxytanks, in aerotanks for biochemical drainage purification.
STEEL ROTOR

Product Density: hub - 6.6-6.8g/cm³, briquette - 7.0-7.3g/cm³

Product Hardness: antifriction layer on piston hole - 600-660 MPa, antifriction layer on end surface 000-1200MPa

Final Weight: 350g

Finishing: piston holes and end surface are subject to mechanical processing (grinding)

Summary: Some of the advantages in the developed technology for applying antifriction layers on piston and end surfaces consist in the following:

- the developed powder material possesses lower friction coefficient (0.008-0.01) in comparison with brass and bronze (0.0350-0.065), higher setting pressure (15-17 MPa) (4-5 MPa), correspondingly and 4-6 times higher wear resistance

- the developed technology for applying antifriction layers allows obtaining good diffusion bonding of antifriction layer with the steel base.
EPMA Award Entries - Materials

ANCORSTEEL AMH
Product Density: 2.50-2.60
Flow Rate: < 30
Composition: 99% Fe
Material being used currently? Yes
Summary: Sponge iron powder has been in use for the PM industry for over 50 years. However, the tunnel kiln reduction process used for the production of sponge iron is energy intensive and also it is difficult to get a pure iron powder as the iron ore used in the reduction process contains undesirable impurities that cannot be removed by this process. There is a need for alternate types of powder for a variety of lower density intricate parts. Hoeganaes has been conducting research on water atomization technology for a number of years and has developed a process to produce a “sponge like” iron powder using atomization from liquid steel.

DISTALLOY AQ
Product Density: 3.04
Flow Rate: 25
Composition: Fe-0.5 Ni-0.5 Mo
Material being used currently? Yes
Summary: The name Distaloy AQ is a result of the material being based on pure iron, ASC100.29 (A), and the fact that it is tailored for quench (Q) and tempering operations. The material is an addition to the range of Distaloy powders that are diffusion alloyed for maximum compressibility and strength. As the other Distaloy powders, Distaloy AQ has a very high product robustness in turn reducing its tendency to dimensional change during processing. The composition of the material also has a positive impact on dimensional stability, which has proven to be very good over all stages - from green blanks to heat treated components.
**INTRALUBE E MIX**

**Product Density:** 3.0g/cm³  
**Flow Rate:** 30sec/50g  
**Composition:** The lubricant is 100% organic  
**Material being used currently?** Yes  
**Summary:** Result: Intralube® E – a new zinc free high performance lubricant for advanced powder mixes.  
- Good lubrication properties  
- Robust filling performance  
- High green strength  
- Environmentally friendly - Zinc free  
- Clean lubricant burn off  
- Suitable for warm die compaction (WDC)  
- Attractive surfaces – no stains on components  
- No deposits in furnace muffle  
- Suitable and robust for warm and humid climates

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**ECOSINT**

**Product Density:** 2.90  
**Flow Rate:** 23  
**Composition:** (1.4-2) Cr – (0.4-1) Ni – 0.8 Mo – 0.2 Mn - (0-1) Cu - (up to 0.75) C  
**Product Hardness:** Adjustable from 83 to 110 HRB  
**Material being used currently?** No  
**Summary:** A group of new high strength and cost effective PM steels has been generated by mixing selected combinations of alloying elements (e.g. Cr, Mo, Ni, Cu, Mn) in different and predetermined concentrations. The main purpose was achieving an optimum balance between compressibility, hardenability and other sintered properties.  

This material is the first one to use all these elements together, adequately combining them and thus taking full advantage of the multiple interactions among its constituents. This allows obtaining high performance PM steels with the minimum alloying content offered in the market for sinter-hardening grades.
**SHADEF**

**Product Density:** bulking density -1,5-1,7 (g/cm³)

**Flow Rate:** size for particles -0.1-45%, 0.06-55%

**Composition:** Iron based

**Material being used currently?** Yes

**Summary:** The present material is currently used for the manufacture of friction products in tractor vehicles. The total volume of products from the material constitutes 120-130,000 pieces per year. The sum is $600,000. The peculiarity for the given material is the fact that the production waste for the ball bearing industry is applied in its manufacture. (slime in rolling the balls). So far it has not been recycled and pollutes the environment. There are no other possibilities for the manufacture of this material other than powder metallurgy.

State Research and Production Association
EPMA Award Entries - Equipment

**UNIVERSAL COINING - A New Method to Reduce the Risk of Jetting**

**Date PM Production First Started:** 2006  
**Equipment being used currently?** Yes  
**Summary:** Jetting is a very common problem when moulding PIM feedstocks. The high viscosity, the high density and the low compressibility are the sources for this problem. ARBURG, manufacturer of ALLROUNDER injection moulding machines for the PIM industry, has developed a control that allows avoiding jetting. The control is called UNIVERSAL COINING and in place since 2006.

The benefits of UNIVERSAL COINING are:
* tight tolerances  
* high density  
* better strength at weld lines

**DORST TECHNOLOGIES - Hydraulic CNC Press Type EP**

**Date PM Production First Started:** 2009  
**Equipment being used currently?** Yes  
**Summary:** New Electrical Servo Drive Compacting Press – a major innovation for the PM Industry.  
Two drive principles are the standard today for powder compacting presses: Mechanical and Hydraulic. In some instances a hybrid combination of both is utilized.

Mechanical presses have long been the work horse of the industry. They combine ruggedness and reliability with economical benefits. Mechanical drives however have constraints caused by the rigidity of the press cycle and the adjustment interdependencies, which limit the flexibility needed for today's PM component production.

Hydraulic presses allow the production of intricate parts with exacting tolerances at high pressing forces. Sophisticated closed loop controls assure the minute alignment of the pressing sequence against set values to attain the most demanding component density and geometry standards. To assure this performance and to function reliably hydraulic presses need regular maintenance.
SERVOELECTRIC POWDER COMPACTING PRESS
Date PM Production First Started: 2009
Equipment being used currently? Yes
Summary: The newly developed CA-SP 160 Electric is a fully servo-electric powder-compacting press and will serve all the powder compacting industries from tungsten carbide to iron powder and special materials. The CA-SP 160 Electric provides a compacting force of 160kN in withdrawal configuration.

Using the Direct Drive Technology for all drives eliminates the need of secondary drive elements like gears and belts. This leads on one side to improved reliability and on the other side to an unmatched dynamic control due to the low inertia of the drives.

The CA-SP 160 Electric will set new standards in Overall Equipment Effectiveness (OEE) and enable the customer to produce higher quality at remarkably lower running costs.

POWDER COMPACTING PRESS PERIPHERALS
Date PM Production First Started: 2009
Equipment being used currently? Yes
Summary: Proment is presenting for the Excellence Awards competition several of its original products, equipment, hardware and software. These products are all designed and built specifically for the benefits of the Powder Metallurgy industry and people. Proment products implementation result with significant power savings, “greener”, plus major cost saving making the PM equipment very economical to own, operate and maintain. Proment has taken the by nature complex PM compacting process and simplified it by design innovation.
EQUIPMENT FOR DRY ISOSTATIC PRESSING FOR PRODUCTS FROM POWDER MATERIALS

Date PM Production First Started: 2001

Equipment being used currently? Yes

Summary: Equipment for dry isostatic pressing for powder materials is developed on the basis of new technical solutions for a scheme of isostatic weighing with the form isolation using material densified from the operating environment (liquid). The equipment ensures attaining long blanks (l>5d) with uniform (by volume) density of various functional area from powders.

Many processes of filtration, aeration, catalysis are intensified at application of powder elements of considerable sizes, e.g. in a form of tubes with a uniform distribution of structural features by volume. Attaining such elements is possible by application of isostatic powders pressing. Attaining porous metallic long elements is impossible with other technologies.
MPIF Awards 2010

**AUTOMOTIVE - ENGINE AWARD OF DISTINCTION**
PMG Füssen, Iwis Motorsysteme GmbH & Co. KG
AUE-210
(V6 Crankshaft Sprocket)

**AUTOMOTIVE - TRANSMISSION AWARD OF DISTINCTION**
PMG Indiana Corporation, Exedy
AUE-510
(Clutch Outer Race)

**HARDWARE / APPLIANCES AWARD OF DISTINCTION**
Asco Sintering Company, Stanley Security Solutions Inc.
HA-110
(Dead Locking Lever)

**HARDWARE / APPLIANCES AWARD OF DISTINCTION**
Capstan
HA-310
(Transfixed Gear & Sector)

**HAND TOOLS / RECREATION AWARD OF DISTINCTION**
Burgess-Norton Mfg. Co
HT-110
(Motorcycle Drive Sprocket)

**HAND TOOLS / RECREATION AWARD OF DISTINCTION**
Megamet Solid Metals, Inc.
HT-310
(Upswept Grip Safety)
INDUSTRIAL MOTORS / CONTROLS & HYDRAULICS AWARD OF DISTINCTION
Lovejoy Sintered Solutions LLC
IC-210
(Counterweight)

INDUSTRIAL MOTORS / CONTROLS & HYDRAULICS AWARD OF DISTINCTION
Lovejoy Sintered Solutions LLC
IC-310
(Tensioner Assembly)

AUTOMOTIVE - TRANSMISSION GRAND PRIZE
GKN Sinter Metals
AUT-110
(Clutch & Carrier Assembly)

HAND TOOLS / RECREATION GRAND PRIZE
Smith Metal Products
HT-210
(Shuttle T-Lock Broadhead)

AEROSPACE / MILITARY GRAND PRIZE
FloMet LLC ATK
AE-110
(Rotor, Safe & Arm)

INDUSTRIAL MOTORS / CONTROLS & HYDRAULICS GRAND PRIZE
Advanced Materials Technologies Pte Ltd
IC-110
(Lock Cover & Barrels)
**JPMA Awards 2010**

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<td>Development of high density &amp; low loss powder magnetic core for reactor in hybrid vehicles</td>
<td>Toyota Motor Corporation</td>
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<tr>
<td>Development of sintered part with complicated shape for seat belt buckles</td>
<td>Sumitomo Electric Industries, Ltd</td>
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<tr>
<td>Housing with sprocket having high density &amp; high dimensional accuracy</td>
<td>Hitachi Powdered Metals Co., Ltd</td>
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<td>Parts for 4WD switching actuator</td>
<td>Porite Corporation</td>
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<td>Iron bronze sintered bearing material which replaces bronze bearing</td>
<td>Hitachi Powdered Metals Co., Ltd</td>
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<td>Sintered oil impregnated bearing material</td>
<td>Porite Corporation</td>
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DEVELOPMENT OF THE OIL IMPREGNATED BEARING
Mitsubishi Materials PMG Corporation

HIGH PRECISION CLUTCH HUB
Fine Sinter Co., Ltd.

NEW BONDED MIX
Höganäs Japan K. K.

DEVELOPMENT OF A GROUP OF SINTERED PRODUCTS FOR MANUAL TRANSMISSION
Mitsubishi Materials PMG Corporation

PARTS FOR STEERING CHILLED WITH DEFECTIVE SHAPE GEAR
Porite Corporation

DEVELOPMENT OF OIL PUMP SPROCKET
Mitsubishi Materials PMG Corporation
European Powder Metallurgy Association

Membership Benefits

10 Reasons to join the EPMA

- European and World PM Production Statistics and information
- Access to PM Technology and Development Programmes
- Networking opportunities at conferences, events and seminars
- Information and lobbying on legislation, such as REACH
- Join the Industry-wide Benchmarking programme
- Discounts on Training Courses, Congresses and Exhibitions
- Free listing on the World’s most comprehensive PM website
- Discounted PM publications, reports and journals
- Weekly email news bulletins and quarterly EPMA newsletters
- Access the ‘Translated Glossary of Powder Metallurgy’

www.epma.com
Metal Powder Report has completely redeveloped its website, improving its functionality and creating the online source of information for the powder metallurgy industry.

It includes new enhanced services:
- Daily updated news
- Podcasts
- Webinars
- RSS feeds

Also available FREE at www.metal-powder.net:
- You can become a member and get access to exclusive content, including full feature articles
- You can sign up to receive our e-newsletter – it will be delivered straight to your inbox every week

* It is all FREE but we do ask you to fill in a quick registration form first