

# 2020 Powder Metal Trends

Edited by Matthew Jaster, Senior Editor

## 20/20 is considered to be perfect vision, but the year 2020 outlook is quite obscure.

We can view the current state of the PM industry through short-term, fear-tinted glasses or gain a clearer picture of long-range opportunities. Just like U.S. manufacturing in general, the PM industry has been impacted negatively by the pandemic.

Many economists forecast a gradual “U” or “W” recovery resulting in a North American recession that will limit new



Dean Howard, PMT, President, MPIF.

housing builds and automotive production. The U.S. has witnessed high unemployment rates nearing the level of the Great Depression. Elk County, Pennsylvania, for example, where the PM industry’s hub St. Mary’s is located, approached 26% unemployment earlier this year, the highest unemployment rate per capita in Pennsylvania. These economic events, unprecedented in modern times, are testing the public consumer and corporations alike.

Cautionary signs seeded the new year with companies forecasting a range of options: low single-digit gains, flat sales, or modest declines in the first quarter. January and February iron powder shipments for PM applications decreased by 5%, before a 19.2% year-over-year plunge in March, a foreshadow of the COVID-19 pandemic. Copper powder and stainless steel forecasts remained flat just before the pandemic storm mutated into a deadly hurricane in

April devastating the entire domestic and global economies. In many areas across the U.S., manufacturing companies were deemed “non-essential businesses” and forced to close their operations to adhere to local government regulations. Companies that had less than 500 employees were eligible for government programs, such as the Payment Protection Program, but many were forced to furlough or lay-off employees.

As signs of the pandemic subsided, shuttered since March, the North American automotive industry resumed production in mid-May. New safety policies, self-distancing protocol, and a disrupted supply chain posed more challenges than expected resulting in the month ending in serious negative territory. Some U.S. factories explored alternative suppliers to compensate for plants that remained closed or were overwhelmed by orders for parts in high demand. General Motors for example, reportedly delayed plans to increase production of pickup trucks in May because of a shortage of parts from Mexico. Many manufacturing plants in Mexico, which surpassed China as the top trading partner to the U.S. last year, were ordered closed early during the pandemic.

Overall, the second quarter appears to be a lost cause for most of manufacturing,

including PM companies.

However, on a positive note, U.S. jobs increased by 2.5 million in May, by far the biggest one-month jobs gain since at least the Great Depression. This gain decreased unemployment to 13.3%, far better than the 19.5% economists had projected. PM equipment suppliers hunkered down as well. A veteran toolmaker reports PM tooling builds are down as much as 75%. Some press and furnace suppliers reported providing start-up services to their customers as most equipment had not been in operation for nearly 2 months.

Traditional PM parts makers are hanging on in a survival mode, especially those connected to automotive OEMs. However, the smaller family-owned shops that are more diversified seem to be doing better.

HVAC manufacturers are still ordering furnaces and air conditioners, along with agricultural, lawn & garden, and medical equipment customers for parts going into hospital beds and wheelchairs. Gym equipment for home use continues to expand and could be an interesting new market for conventional PM due to shelter-in-place orders.

One family-owned company executive reports some customers have moved up ordering to build up inventories



The PM industry hopes to return to its normal trade show schedule in 2021 (all photos courtesy of MPIF).



The PM industry is well-equipped to handle the current challenges in 2020.

for the future. As a result, he sees June orders rebounding somewhat. He is also making lemonade from the lemons he is dealing with by investigating process improvements, such as reducing scrap. In another facility, company engineers are devoting time to installing and qualifying new robots connected to compacting presses, furnaces, and machining

centers. Automation will continue to be utilized industry-wide.

Another family-owned facility recently experienced a surge in new, mostly non-automotive parts. They also reported an increase in former customers investigating the option of reshoring parts that were lost to low-cost suppliers over the past decade.

MIM and metal AM markets have a brighter outlook in 2020. The firearms and medical markets will dominate MIM production again. Firearms sales, for both handguns and long guns, are expected to be robust in response to recent social injustices and this Fall's presidential election. Medical and dental shipments could suffer a slight downturn as elective medical/dental procedures were prohibited due to state lockdowns. At best, MIM parts sales may increase by single digits or stay even with last year.

Metal AM continues to be on a roll, especially for aerospace and medical applications such as custom implants that replace forgings. Some common metal AM materials include nickel-cobalt alloys, aluminum-silicon-magnesium alloys, low-alloy steel, stainless steel and Inconel. Without a doubt, the global automotive market is changing. Long standing PM champions face a shrinking universe of opportunities.

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While the Detroit 3, General Motors Corporation, Ford Motor Company, and Fiat Chrysler Automobiles, restarted production in mid-May, forecasts for light vehicle sales and production still look gloomy. Who would have thought that we would be offered incentives to purchase vehicles that included no interest for 84 months, no down payment, and 120 days before the first payment? During the midst of the shutdown, IHS Markit forecasted a 26.7% sales collapse in North America directly related to the pandemic. The result is the U.S. auto market sales dropping to 12.5 million units and production declining to 12.2 million units.

We need to keep an eye on this as we are nearing record levels of unemployment that will also negatively affect automotive sales.

As of July 1, 2020, new rules now govern how vehicles are produced as a result of the United States–Mexico–Canada Agreement, or USMCA, including that rules of origin are to be met on automobiles, specifically that 75% of the finished vehicles' value is to come from within the USMCA governed region: an increase of 12.5% from the previous North American Free Trade Agreement, or NAFTA. This could be a great opportunity for re-shoring parts and assemblies.

Opportunities still exist for new PM designs outside of engines and transmissions. There could be a new metric rising besides focusing on pounds per vehicles based on large parts. Are there opportunities in smaller more highly engineered PM parts in non-drivetrain systems? Have we begun to tap the hybrid vehicle and electric vehicle markets? Low gasoline prices will delay the move from larger to smaller engines, but gaining acceptance of PM in 3- and 4-cylinder hybrid vehicles should be a primary focus.

And what about the millennials?

Will they continue to choose ride-share services, rental cars, bicycles, and electric scooters over car ownership? Many news reports suggest that the COVID-19 pandemic has changed the minds of many millennials who will prefer their own automobile and house over the risk of cross-contamination

and recirculating air in apartments and condominiums.

The PM industry has a strong technology base, built on the interaction of manufacturers, academia, and research organizations. As a maturing industry, we must not let this diminish as every industry needs to continue to evolve or it will simply die. Investments in R&D for new materials, equipment advancements, and process refinement will need to remain strong. Metal powder producers are actively working on high-performance materials. For example, one powder producer is focusing on a specialized material with high-apparent density to improve die-filling for thin-walled parts and faster production rates. Another powder producer is launching stearate-free lubricants for medium to high-density compaction. A third powder producer is focusing on advanced machinability additives to improve tool life and productivity by reducing machining cycle-time.


Compacting press and sintering furnace suppliers are also dedicated to improvements. Some advancements include faster tool exchange systems, electric presses for high-production manufacturing of smaller PM parts, and implementation of robots. Sintering improvements include a new approach to remove lubricants from green compacts thoroughly prior to sintering and reducing energy expenses by up to 80%.

Metal AM could become a significant growth market for aluminum powders as customers explore the light metal's environmental and light-weight benefits. Metal AM trends in the next decade will focus on enhancing throughput, printing larger parts, multi-material printing, and repairing and refurbishing expensive parts and tooling.

There continues to be tremendous activity in the metal AM sector. From one manufacturer concentrating on making large parts, up to 450 kg (992lb), for the aerospace and defense industries, to another developing binder-jet printing of tungsten heavy alloys and the directed energy deposition of molybdenum, there are a lot of opportunities for this exciting sector. In addition, advances continue

for metal AM processes such as binder jetting, material extrusion, and material jetting, all of which are de-bound and sintered, leveraging the successes of the MIM technology.

The one certainty for 2020 is uncertainty. The future is bright for manufacturing adaptation and the PM industry. Despite armies of naysayers from every political persuasion, positive signs are flashing on the horizon for U.S. manufacturing. Ugly short-term tremors cannot define us. Fortunately, throughout its history, the PM industry has survived the ups and downs of the macro economy. The industry is well-prepared for whatever comes our way and well-equipped to shape the future. We will improve the technology through R&D, education, and cooperative efforts, while adapting our resources to ensure we can respond in an agile manner to forces beyond our control, such as the COVID-19 pandemic.

The entrepreneurial spirit embedded in PM's DNA is still alive. Opportunities are waiting to demonstrate PM's problem-solving advantages for now and the future. 

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## PM Design Excellence Awards 2020 - Automotive

Innovation is at the hub of powder metallurgy (PM) manufacturing advancements in the automotive market. PM materials and consolidation processes are utilized to support the most demanding applications. Transmissions, engines, and chassis rely on performance components to provide durability and consistency.

### Automotive Grand Prize Awards

The Grand Prize in the Automotive — Engine Category for Conventional PM components has been awarded to Porite Taiwan Co. Ltd. and their customer Schaeffler Technologies AG & Co. KG, for a VVT sprocket used in a new generation E-VVT design that integrates

a sprocket with the stator, and the function of the internal rotor is provided by the gear box.

A Grand Prize has been awarded to PMG Indiana Corporation in the Automotive — Transmission Category for Conventional PM components for a torque converter one-way-clutch stator assembly used in an 8-speed transmission made for FCA US LLC. In the locked position the part is subjected to a 350 Nm torque and traditionally the races are manufactured from wrought steel, or powder forged, and case

hardened to handle the high stress.

In the Automotive — Transmission Category for MIM components, a Grand Prize has been awarded to Phillips-Medisize — Metal Injection Molding for an actuator arm supplied to Means Industries and used in a 9-speed forward transmission assembly for General Motors and Ford Motor Co. The actuator arm is part of a Means patented selectable one-way clutch that replaces the reverse clutch.

### Automotive Awards of Distinction

In the Automotive — Engine Category for Conventional PM components, an Award of Distinctions has been given to Nichols Portland LLC for a variable displacement vane-pump rotor used in an automotive engine lubrication system. The three-level part possesses numerous critical tolerance features achieved with minimal secondary operations.

The second Award of Distinction in the Automotive — Engine Category for Conventional PM components. This was given to MPP for a high-strength camshaft-bearing cap. The part is made using a PM aluminum-copper-magnesium alloy. The machinability of the PM aluminum alloy closely matches that of the cast aluminum heads, permitting consistent line boring prior to installation of the camshaft.

An Award of Distinction in the Automotive — Engine Category for MIM components has been given to Indo-MIM Pvt. Ltd. for three min-flow setting devices used in the turbocharger of a four-wheeler vehicle. The parts are made using MIM-316L and replaced components that were machined in multiple steps.

In the Automotive — Transmission Category for Conventional PM components, an Award of Distinction has been made to Allied Sinterings Inc. for a sinter pin assembly. The part is used in a shift-by-wire automotive transmission



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actuator that causes an output shaft to rotate the sear pin, allowing a pawl to engage a default-to-park during a catastrophic transmission failure.

In the Automotive — Transmission Category for MIM components, an Award of Distinction has been given to Indo-MIM Pvt. Ltd. for a park lock lever manual override used in a vehicle handbrake.

An Award of Distinction has been given to Indo-MIM Pvt. Ltd. in the Automotive — Chassis Category for



MIM components, for left- and right-hand-side cable guides used in a four-wheeler roof assembly. The MIM parts are made in a two-cavity mold and replaced expensive machined components.

**PM Design Excellence Awards 2020 — Special Technologies**

From prototypes to mass production, powder metallurgy (PM) technologies like metal injection molding and metal additive manufacturing have been changing the manufacturing landscape across market segments.

Aerospace and defense have utilized PM technology for incredible innovations, the use of PM in the electronic and electrical market impacts our daily lives, and PM in the medical and dental field enhance patient care and quality of life every day.

It is with great pleasure that the Metal Powder Industries Federation announces the winners of the 2020 Powder Metallurgy Design Excellence Awards

Competition in the special technologies market segment.

**Grand Prizes**

The Grand Prize in the Aerospace/Military/Firearms Category for MIM components, has been awarded to Advanced Powder Products Inc. for a trigger mechanism housing for a new 9-mm sub-compact pistol produced for O.F. Mossberg & Sons Inc. The component originally comprised two pieces (metal and plastic), and was re-designed as a single MIM part. Over 5,000 rounds were fired to test the part and no failures were observed.

Advanced Powder Products Inc. also received the Grand Prize in the Medical/Dental Category for MIM components, for a guide tube used in dental surgery. This extremely small part has very thin wall sections and a built-in impingement plate on the inner diameter of the tip. This impingement plate has a Gaussian curvature that can only be formed economically by metal injection molding.

**Awards of Distinction**

In the Aerospace/Military/Firearms Category for MIM components, an Award of Distinction has been given to Alpha Precision Group — Metal Injection Molding for a shroud that houses the firing pin and firing pin collar in a bolt-action rifle.

An Award of Distinction in the Aerospace/Military/Firearms Category for MIM components, has also been given to ARC Group Worldwide for lever actuators for vanes in a turbo-prop engine. The actuators control the angle of the variable inlet guide vanes and the variable stator vanes.

An Award of Distinction has been given to 3DEO in the Aerospace/Military/Firearms Category for metal AM components, for an anchor link used in a firearms application. A hybrid metal AM

process is used to make the parts.

In the Medical/Dental Category for MIM components, an Award of Distinction has been given to MPP and their customer Coracoid for a buckle used in an implanted shoulder repair device. Several technologies were considered for making the part but MIM processing was the only one that produced a part that could withstand the stresses induced during the cinching of the device during surgery and the placement of the cleat.

An Award of Distinction has also been given in the Medical/Dental Category for MIM components to OptiMIM and their customer Atricure for one of two jaws of a surgical device for deploying a clip around a heart's left-atrial-appendage. The mold produces two parts that are mirror images of one another.

An Award of Distinction has been made to ARC Group Worldwide and their customer Cutsforth Inc. in the Electronic/Electrical Components Category for MIM components, for a lower beam EZ change holder for removable brush holders. They are used in brush excitation maintenance on turbine generators in the nuclear, gas, coal, wind,



and hydro industries. ([www.mpif.org](http://www.mpif.org))

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