State of the PM Industry in North America—2019
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The powder metallurgy (PM) industry began 2019 facing a subdued business outlook. Red flags warned caution ahead. But first, let us begin with a review of 2018 posting modest growth for most PM sectors.

The traditional press-and-sinter sector gained last year, along with metal injection molding (MIM) companies enjoying stronger sales increases in the 5% to 10% range. Metal powder producers and PM equipment builders reported positive gains with equipment companies reporting rising demand for automation packages and robotics. Interest in metal additive manufacturing (AM) continues at a rapid pace. But AM companies are still tackling challenges related to qualifying parts for commercial production runs.

Metal Powder Shipments & Trends

North American iron powder shipments in 2018 grew by 1% to 392,995 mt (433,203 st), Figure 1. PM and friction grade powder shipments were almost even with 2017 at 357,590 mt (394,176 st). Iron powder shipments for welding applications increased by 11% to 15,839 mt (17,460 st). Iron powder going into other uses increased rose by 5.7% to 19,565 mt (21,567 st).

Figure 1. North American Iron Powder Shipments (1 st = 0.907 mt)
2018 iron and steel powder shipments in Europe and Japan were almost even with 2017, a similar result to North America.

Estimated North American stainless steel powder shipments in 2018 remained even with 2017 at 7,938 mt (8,750 st). Copper powder shipments increased by an estimated 2% to 16,783 mt (18,500 st). Aluminum powder shipments increased 2% to an estimated 30,536 mt (33,660 st). Nickel powder consumption declined about 3.5% to an estimated 5,534 mt (6,100 st). Molybdenum shipments declined an estimated 23.4% to 856 mt (944 st). Tungsten powder shipments decreased by an estimated 7.4% to 1,588 mt (1,750 st), and tungsten carbide powder shipments decreased an estimated 1.6% to 7,792 mt (8,590 st). Overall 2018 total North American metal powder shipments gained modestly by just under 1% to 464,022 mt (511,497 st), Figure 2.

<table>
<thead>
<tr>
<th>North American Metal Powder Shipments</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron &amp; Steel</td>
<td>428,978</td>
<td>433,203</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>8,750 E</td>
<td>8,750 E</td>
</tr>
<tr>
<td>Copper &amp; Copper Base/Tin*</td>
<td>18,150 E</td>
<td>18,500 E</td>
</tr>
<tr>
<td>Aluminum</td>
<td>33,000 E</td>
<td>33,660 E</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>1,240 E</td>
<td>944 E</td>
</tr>
<tr>
<td>Tungsten</td>
<td>1,892 E</td>
<td>1,750 E</td>
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<tr>
<td>Tungsten Carbide</td>
<td>8,726 E</td>
<td>8,590 E</td>
</tr>
<tr>
<td>Nickel</td>
<td>6,325 E</td>
<td>6,100 E</td>
</tr>
<tr>
<td>(E) estimate</td>
<td>507,061</td>
<td>511,497</td>
</tr>
<tr>
<td>*PM parts only</td>
<td>short tons</td>
<td>short tons</td>
</tr>
</tbody>
</table>

Figure 2. North American Metal Powder Shipments (1 st = 0.907 mt)

The Outlook for 2019

Depending upon your market niche, 2019 looks like a flat year or modestly down for the press-and-sinter business. PM’s heartland in Western Pennsylvania remains positive, but there is some softening reported through the first quarter. The lawn & garden market is holding up well. So are appliances and construction equipment. Nevertheless, the automotive segment continues to raise concern.

In September 2018, MPIF performed its annual PM Industry Pulse Survey. Of the responding members of the Powder Metallurgy Parts Association, 62% projected an increase in capital spending for 2019; 31% reported spending remaining the same as 2018.
Long standing family owned PM parts makers are still thriving. Three typical medium size companies in the Midwest and Pennsylvania expect fairly strong gains this year. A CEO of one company reports, “Customers can speak to the owner on the phone with no bureaucratic interference.” Another company executive says, “We provide quick decision making.”

Nevertheless, the metal powder market is uncertain. Some observers believe negative powder shipments, reported during the first quarter of 2019, are signaling a further weakening market or a slowdown in demand. Caution reigns at best for the remainder of the year.

Equipment builders forecast a slower year with interest in larger compacting presses in the 350- to 550-ton range. The press market seems to be settling into annual builds of 20 to 25 presses. Automation of presses and robotics in furnace loading continues as a steady trend.

**The Automotive Market**

The traditional PM industry’s most important market is driving into a new era with no brakes. Everything is changing—the product mix, the demographics of consumers and the trend to hybrid vehicles (HV), electric vehicles (EV), and self-driving or autonomous vehicles. Many observers forecast the PM industry’s major market will slowly decline in the next five to 10 years. This offers both challenges and opportunities for everyone.

Uncertainty overhangs the business climate for 2019, depending upon what automotive platforms parts makers are supplying. In addition, total North American vehicle sales are expected to decline below 17 million units. Early estimates range from 16.5 to 16.8 million units.

Traditional passenger car models are out of fashion, especially among millennials. An article headline in the New York Times has a tongue-in-cheek but sobering omen for car makers and their suppliers—“Owning a Car Will Soon Be as Quaint as Owning a Horse.” Start ordering shovels now while you can.

Without a doubt, hybrid and electric vehicles are here to stay. Some predict electric vehicles will account for 10% of the automotive market within the next 10 years. Right now there is no practical infrastructure yet for plug-ins. But it will happen and the PM industry must be ready. And there is more sobering news. Norway has launched an ambitious plan to offer only electric cars for sale beginning in 2025. The goal is electric or hydrogen or plug-in hybrids. Currently 37% of Norway’s automotive market consists of hybrid and electric vehicles.

Electric vehicles offer opportunities for innovative PM designs. For example, soft magnetic composite cores could be used in main drive motors and motors for oil and cooling pumps.
While demand for SUV and light trucks is still thriving in North America, the new models contain smaller engines (six and four cylinders) with smaller, more efficient nine to 10-speed transmissions. The result is less weight with fewer connecting rods and main bearing caps, which equates to less powder shipments even though some top-of-line fully loaded AWD trucks contain more than 45 kg (100 lb) of PM parts. The average light truck model such as the Ford F150, Chevrolet Silverado, or the Dodge RAM 1500 classes contains about 34 kg (75 lb) of PM parts. The result of the overall decrease in number of cylinders and other lightweighting activities have reduced the average weight of PM parts in North American passenger vehicles to 19.5 kg (43 lb).

Auto engineers are utilizing more modeling of designs and less time-consuming, physical testing to reduce costs and decrease time to market. Adequate data for modeling powder metallurgy parts is lacking. Filling this need calls for additional data to be generated and added in the Global PM Property Database.

**Metal Injection Molding and Additive Manufacturing Trends**

The 2019 outlook for metal injection molding (MIM) remains positive and firm. Estimated 2018 sales of MIM parts in the U.S. increased by a range of 5%–10% ($440 to $460 million). In contrast, estimated sales of MIM parts in China (including Taiwan) exceeded $1 billion. European MIM parts sales track U.S. sales closely or are slightly higher. Total global MIM parts sales are estimated at about $2.6 billion.

It is estimated that MIM-grade fine powders consumed in the U.S. (domestically produced and imported materials) increased by up to 10% in 2018 to 3,465,000 kg (7,623,000 lb). This amount also includes fine powders for metal additive manufacturing (AM) applications. Based on the MPIF PM Industry Pulse Survey, responding members of the Metal Injection Molding Association (MIMA), Figure 3, report an estimate of materials used by weight of MIM parts shipped.

Figure 4, shows the MIM market mix also according to weight of parts shipped. The medical and dental markets will continue growing along with MIM parts in vehicles. The firearms market flattened in 2018 with 2019 experiencing more of the same.
Optimism dominates market expectations for 2019. The MPIF PM Industry Pulse Survey reports that 72% of MIMA respondents forecast sales increasing and 28% of MIMA members forecast more stable sales levels. The most important reported manufacturing/engineering challenges facing 2019 include reducing time-to-market, expanding capacity, reducing scrap, and developing new materials. MIM companies are also actively considering potential manufacturing marriages with AM processes.
Metal powder suppliers, domestically and internationally, are expanding R&D programs and production capacities for a variety metal AM-grade fine powders. They include: cobalt-chrome, titanium, aluminum, stainless steel, low-alloy steel, tool steel and copper, tungsten and tungsten carbide alloys, the Inconel family of materials, and aluminide alloys such as titanium aluminide and nickel aluminides.

Technology Trends

Technology never sleeps in the PM industry. It's always reinventing itself with new materials, processes and products that spell innovation for the future. Metal powder makers, equipment builders, and PM process companies are all investing in new technology to expand the total market.

Enhanced lubrication systems have been developed to extend tool life and improve surface finish of PM parts. There is also work on binder-treated powder blends and low-segregation additives. New aluminum alloys are available to meet demands for traditional PM, additive manufacturing and metal injection molding.

Developments in field-assisted sintering show a trend to flash or ultra-rapid processing emphasizing net-shaping capabilities. The flash feature of electric-current and electromagnetic field-assisted sintering is achieved in flash sintering, flash spark-plasma sintering, flash microwave sintering, and high-voltage electric discharge compaction.

The MPIF Technical Board, comprised of the top engineering, research and development professionals representing all facets of the powder metallurgy industry, provides leadership and direction of all MPIF technical activities to advance powder metallurgy and particulate materials. In an effort to improve overall process controls in PM parts production, the Technical Board sponsored a special interest program on machinery sensors and information technology. Designing intelligent sensors for sintering furnaces and compacting presses will provide the diagnostics for more precise controls that can expand PM’s reach in the global advanced materials marketplace.

The Center for Powder Metallurgy Technology or CPMT has been a leader in encouraging university students to learn about PM. Through the Clayton Family Scholarships for Studies in PM, Howard I. Sanderow Scholarship, and North American Höganäs Scholarships, CPMT has provided over $530,000 to 156 students since the year 2000 and more than $146,000 through its CPMT/Axel Madsen Conference Grants Program to 113 students since 1990. Additionally, and unrelated to CPMT, this year’s POWDERMET2019 & AMPM2019 conferences hosted 72 students who received funds to attend, including 40 students funded by the National Science Foundation (NSF) and 32 by MPIF through a new MPIF Student Grant program. This exposure to engineering opportunities provided by
PM will undoubtedly provide new well-trained professionals for the industry or informed potential design engineers and customers.

In addition, recent R&D undertaken through CPMT includes strain-controlled fatigue, rust prevention, impact testing of gear teeth, and die wall lubrication for warm tooling compaction.

**Conclusion**
The PM industry is still on the move and should never be counted out or labeled a mature industry and technology. Many times, throughout the industry’s long history, so-called pundits have predicted a declining curve and written off PM’s future. And many times, they have been proven wrong. PM will continue to solve problems and innovate as long as we invest in people and new ideas.

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**About the Metal Powder Industries Federation**
Metal Powder Industries Federation is the North American trade association formed by the powder metallurgy industry to advance the interests of the metal powder producing and consuming industries and provides a single point of reference for all MPIF member companies.

**About APMI International**
APMI International is a non-profit professional society which promotes the advancement of powder metallurgy and particulate materials as a science. Its purpose is to disseminate and exchange information about PM and particulate materials through publications, conferences, and other activities of the society.

**About the Center for Powder Metallurgy Technology**
The Center for Powder Metallurgy Technology merges the academic and corporate powder metallurgy worlds together with a joint goal to promote PM industry progress. This progress depends on the business community and its drive for profit, and it also takes the educational community with its dedication to research and the pursuit of knowledge.