ENVIRONMENT, HEALTH & SAFETY IN PM
HYBRIDISATION OF PICK-UP TRUCKS
EPMA PM ACTIVITY IN EUROPE
We are in unprecedented times. However, these are the times when agility, resilience and innovation of our people define our businesses.

At Rio Tinto Metal Powders we have implemented social distancing measures, promoted good hygiene habits and applied new site access requirements including body temperature measurements. Furthermore, at our Technology Centre in Sorel-Tracy, we produced hand sanitizer to keep our employees and communities’ safe – even supplying paramedics. We also donated hundreds of N95 (FFP2) masks to the local hospital.

These initiatives make Rio Tinto a part of the solution in the fight against COVID-19. If you are proud of your initiatives, share with us and we will publish them in our next Customer Bulletin. We are all in this together, and it is through teamwork and innovation that we will rise to the challenge. Please feel free to contact your regional sales representative should you have any concerns during the COVID-19 crisis or email us at info.qmp@riotinto.com
Continuing in uncertain times

As we go to press here in the UK, it feels as if we are still firmly caught in the middle of the devastating coronavirus pandemic. Although businesses have begun to re-open, and the wheels of industry across the world start turning once more, there are certain freedoms that will not be accessible for some time to come.

The participation in conferences and exhibitions is one such activity that has been curtailed. The safety of all participants is of course paramount, and just when it will be safe for mass gatherings such as these to resume is a decision not be to taken lightly.

In the Powder Metallurgy sector this resulted in the cancellation of WorldPM2020, the World Congress on Powder Metallurgy & Particulate Materials - the highlight of this year’s event calendar, scheduled to take place in Montreal, Canada, in June.

Whilst we may not meet you in person at an exhibition this year, or be able to report on the cutting edge developments presented at conferences, rest assured that we will still be reporting on the latest news from the industry, as well as highlighting key applications and the potential for PM technology in PM Review magazine.

Paul Whittaker
Editor, Powder Metallurgy Review

Cover image
The electric motor with reduction drive developed by Höganäs and partners (Courtesy Höganäs AB)
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in this issue

51 Are you safe or lucky? A look at Environment, Health & Safety in the PM industry
Many regulations are in place to avoid dangers to operatives in a Powder Metallurgy facility. However, as with many manufacturing industries, there can be circumstances where hazardous situations arise and accidents can happen. In this article, Paul Hoffmann explains some of the unique risks associated with operating a PM facility, highlighting the dangers and introducing some of the procedures that can be implemented to help avoid them.

61 Hybridisation of pick-up trucks and the impact on the content of sintered parts
Höganäs AB has over the last few years conducted teardowns on a number of vehicles to help identify potential applications for Powder Metallurgy components. Building on this, Höganäs, Alvér Mechatronics and Dontyne Gears have worked to develop a hybrid drive system concept, utilising a number of PM components, aimed at the truck and SUV class. Höganäs’s Dr Anders Flodin discusses their joint efforts and demonstrates the mixed drive solution.

71 EPMA’s General Assembly reviews Powder Metallurgy trends in Europe
Due to the coronavirus pandemic, the European Powder Metallurgy Association (EPMA) held a virtual General Assembly in April, with some thirty members taking part online. Bernard Williams presents summaries of key presentations on the current status of PM in Europe, and the broad range of activities of the EPMA sectoral working groups, Club Projects and EU funded projects.

79 Metal powder recycling: Innovative technology is turning waste into resources
With the help of new technologies, such as a vacuum distillation process developed at Cronimet Envirotec, a wide range of metal waste, from metal-bearing dust to blasting abrasives and metal powder, can be recycled and returned to the production cycle. Cronimet Envirotec recovers metal residues Alia Smektala explains how the process can work for metal powder-based industries.

regular features

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**Kymera closes deal to buy Reading Alloys**

Speciality materials company Kymera International, Raleigh, North Carolina, USA, has closed its transaction with Ametek, Inc., Berwyn, Pennsylvania, USA, to acquire 100% of the shares of the Reading Alloys business.

Founded in 1953 and acquired by Ametek in 2008, Reading Alloys designs, develops and produces master alloys, thermal barrier coatings and titanium powders. The business is a supplier for producers of high-quality titanium and super alloy mill products that are used in aerospace and aircraft applications.

Kymera has been owned by affiliates of Palladium Equity Partners, LLC, New York, New York, USA, a middle-market private equity firm with approximately $3 billion in assets under management, since 2018. The terms of the transaction were not disclosed.

“Reading Alloys is an outstanding company with highly skilled people and an excellent product and end market portfolio that fits in perfectly with our existing business,” stated Barton White, CEO of Kymera. “For Kymera, we believe this is a transformative acquisition that will give our combined company strong technical and commercial resources to help fuel our growth in the aerospace, defence, medical and industrial markets.”

“The acquisition of Reading Alloys, Kymera’s third to date under Palladium’s ownership, is right on strategy as the Kymera management team continues to build the company into a leading specialty materials producer,” commented Adam Shebitz, a Partner at Palladium.

www.kymerainternational.com

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**Metal Technology Co acquires Sandvik Powder Solutions AB**

Metal Technology Co. Ltd., a leading metal processing company headquartered in Tokyo, Japan, has announced a share transfer agreement to acquire all the shares of Sandvik Powder Solutions AB, a subsidiary of Sandvik Group. The acquisition was scheduled to be completed by the middle of April 2020.

Sandvik Powder Solutions, located in Surahammar, Sweden, is a Powder Metallurgy business that designs, manufactures and sells near-net shape products used primarily in the oil & gas industries. The company is reported to have a strong customer base worldwide, including in the US and Europe, as well as a high level of technological capabilities that extend from design to the completion of products. In 2018, Sandvik Powder Solutions had sales of some SEK 78.5 million (€7.2 million) and a workforce of thirty-two.

“We provide integrated metal processing services centred on metallurgy technologies, primarily in heat treatment and HIP treatment. In 2010, we established a subsidiary in China to build business relationships with customers in Asia. By acquiring Sandvik Powder Solutions, we aim to expand business opportunities in Europe, Japan and China, and to enter the Oil & Gas industry, where we excel,” stated Metal Technology Co.

www.kinzoku.co.jp
www.mtcpowdersolutions.com

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Severstal completes acquisition of carbonyl iron powder producer Sintez

PAO Severstal, a leading steel and steel-related mining company headquartered in Moscow, Russia, has acquired 100% of the shares of Sintez-CIP Ltd and Sintez PP Ltd, the owners of the only producer and supplier of carbonyl iron powders in Russia and the CIS region. Sintez-CIP will become part of Severstal’s metal-ware manufacture division, under the operational management of Sergey Kovryakov, CEO of Severstal-metal.

Sintez-CIP produces a wide range of unique carbonyl iron powders for firms around the world. Carbonyl iron powder is used in various Powder Metallurgy processes and Metal Injection Moulding (MIM) technologies. It is also widely used in electronics, primarily in the automotive industry (electronics in cars, electric vehicles), as well as in the manufacture of household appliances, mobile phones, computers, and televisions.

Sintez-CIP is reported to be the second-largest producer of these products globally, holding approximately 10% of the market share. The company produced more than 1,500 tons of finished goods last year, and exported more than 95% of its sales.

Alexander Shevelev, CEO of Severstal, commented on the acquisition, “This investment reflects our focus on two of Severstal’s strategic priorities – ‘New Opportunities’ and ‘Excellent Customer Experience’. Through the implementation of breakthrough technologies, we are bringing unique solutions to the market in order to satisfy the needs of modern customers, as well as, in some cases, anticipating their future demands.”

“Integrating Sintez-CIP into Severstal will add a new trajectory of development for the company into promising markets such as electronics, where we expect sustained growth through key developments,” he continued.

“Examples include the electrification of transport, the development of telecommunications infrastructure, mobile electronics, and finally ‘Binder Jetting’, which is considered to be an important technological breakthrough due to its high processing speed and low costs.”

Andrey Laptev, Director of Business Development and Corporate Venture Projects at Severstal, added, “Sintez-CIP has unique competencies that have enabled it to occupy 10% of the fast-growing global carbonyl iron market, and continually increase its presence in the most promising segments of the sector.”

“We are aiming for consistent growth in this high-margin market, using the broad competencies and market opportunities Severstal has cultivated,” he explained. “Our overarching goal is to create a world-class Powder Metallurgy centre of excellence within the business. Sintez-CIP allows us to expand our market influence, and also creates a springboard for us to enter international markets.”

www.severstal.com
https://en.sintez-cip.ru/

VDM Metals sold to stainless steel group Acerinox

Acerinox, S.A. a multi-national stainless steel manufacturing group based in Madrid, Spain, has acquired VDM Metals GmbH, Werdohl, Germany, in a transaction valued at €532 million. VDM Metals is a global supplier of metals which, among its products, offers a range of metal powders for Additive Manufacturing. The acquisition has received approval from the relevant authorities.

The activities performed and products manufactured by Acerinox and VDM in their respective fields are said to complement each other, and the transaction will have clear manufacturing, sales and distribution benefits for both companies. The new group company is expected to be a global leader in the development and manufacture of special nickel alloys, as well as high-performance stainless steels, as well as an R&D and innovation benchmark in the industry.

“In the circumstances we are currently living, this acquisition makes more sense than ever, since it diversifies our risk, adds a business line and establishes a strategy that we believe will be successful, in addition to strengthening the group’s competitiveness and robustness. Furthermore, the cash generation and decrease in debt recognised last year leaves us in an optimal situation for taking on this challenge,” stated Bernardo Velázquez, CEO of Acerinox.

VDM has seven production plants in Germany and the USA and employs almost 2,000. In 2018/19, VDM achieved sales of €852 million and EBITDA of €97 million. Its incorporation into Acerinox is expected to increase its net sales and billings by more than 20%.

www.vdm-metals.com
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MPIF cancels WORLDPM2020, AMPM2020 and Tungsten2020 due to coronavirus

The Metal Powder Industries Federation (MPIF) has announced that the 2020 World Congress on Powder Metallurgy & Particulate Materials (WorldPM2020), the 2020 Additive Manufacturing with Powder Metallurgy conference (AMPM), and the 10th International Conference on Tungsten, Refractory & Hardmaterials (Tungsten2020), which were scheduled to take place at the same time in Montréal, Canada, from June 27–July 1, 2020, have been cancelled due to the spread of coronavirus (COVID-19).

In an official statement, Jim Adams, the MPIF’s Executive Director/CEO, wrote “After thoughtful deliberation, it is with a sad and heavy heart that a decision has been made to cancel the WorldPM2020, AMPM2020, Tungsten2020 conferences to have taken place June 27–July 1 in Montréal. The conferences will not be rescheduled.”

“Our technology’s advancement is greatly affected by the lost opportunity for our speakers to present the latest research and to collaborate with colleagues. Our suppliers and service providers are unable to present the cutting-edge advancements in materials, equipment, and services. However, all speakers and exhibitors have been encouraged to share these technology advancements next year at PowderMet2021 and AMPM2021, June 20–23, 2021, in Orlando, Florida, USA. Unfortunately, the 10th Tungsten, Refractory and Hardmaterials conference will not be held in 2021.”

Adams added, “We are grateful to everyone who has worked tirelessly with planning, promoting, and supporting the Montréal conferences, the Metal AM Tutorial, and all other conference activities. We ask for your patience as we work diligently to address questions and provide additional information to all who are impacted by this cancellation.”

www.mpif.org

Equispheres secures C$30 million investment round

Equispheres, a materials science company based in Ottawa, Ontario, Canada, has raised Series B investment and a new round of funding totalling C$30 million. The round of funding was led by advanced materials and sustainable technology investor HG Ventures, with participation from Sustainable Development Technology Canada (SDTC), BDC and other undisclosed contributors.

Within the last year, Equispheres has released two major reports on the results of testing on its unique metal powders. One outlined how its powder outperformed in Additive Manufacturing aerospace-ready quality tests, and another revealed that the company had been successful in developing an aluminium alloy powder suitable for Binder Jet Additive Manufacturing, which was previously unfeasible.

According to the company, this new funding will largely be used to scale up production capacity and facilitate R&D efforts with strategic industry partners, focusing on the following areas:

- Improving reactors for higher volume and lower cost production
- Accelerating research and development projects with strategic partners in the automotive, aviation, space and defence industries
- Hiring and developing talent, creating high-quality jobs
- Developing application support services for the automotive, aviation, space and defence industries to facilitate advanced manufacturing opportunities made possible with the materials Equispheres has developed

Kevin Nichols, President and CEO of Equispheres, stated, “We are extremely excited to have HG Ventures as a partner; their extraordinary combination of research capability and venture capital experience made them an ideal partner to understand both the technical and market potential of our product across the transportation industry. We are also grateful to have the support of the Canadian government, enabling us to leverage investor financing to achieve our objective of providing a high-quality product at volume levels the marketplace demands.”

www.equispheres.com

EPMA Virtual Congress to replace Euro PM2020 in light of coronavirus

The European Powder Metallurgy Association (EPMA) has confirmed that, due to coronavirus, a Virtual Congress will be held in place of Euro PM2020, originally scheduled for Lisbon, Portugal, October 5–7.

The new online event is expected to allow all 300+ technical papers to be presented during a live webinar, and is scheduled to take place over the same dates as the original congress (October 5–7, 2020).

It was stated that given the difficulties participants may have travelling to Lisbon, as well as the high safety and financial constraints of running a live meeting in 2020, the EPMA Board had decided to postpone the live Euro PM Congress & Exhibition event. Euro PM2021 will now take place in Lisbon, Portugal, October 17-20, 2021.

www.europm2020.com
Our Laboratory is available for third party analyses, both for powder customers and also for any other application and industry.

mimete.com/lab-offer
Bodycote completes $200 million acquisition of Ellison Surface Technologies

Bodycote plc, Macclesfield, Cheshire, UK, reports that it has completed its acquisition of Ellison Surface Technologies, Inc., an engineered surface coating provider headquartered in Mason, Ohio, USA. The acquisition creates one of the largest providers of thermal spray and engineered coating surface technology services in the world.

In December, it was announced that the gross consideration for the acquisition would be $200 million. According to Bodycote, $120 million was paid on April 3 2020, the date of completion, with the remaining $80 million due for payment on April 3, 2021. Ellison Surface Technologies’ business generated revenues of $59 million for 2019, with associated pro-forma EBITDA of $12 million. This represented revenue growth on 2018 of 17%, while pro-forma EBITDA increased 48%, reflecting the fact that Ellison has been successfully gaining share. The company states that this positions the business for further revenue and profit growth in future years. Bodycote will receive tax benefits worth at least $30 million in the years to come. Ellison employs almost 400 people across six sites located in the United States, Canada and Mexico.

According to Bodycote, it will continue to execute its strategy to invest in Specialist Technologies and secular growth businesses and Ellison’s business is believed to be an excellent strategic fit with Bodycote’s existing Surface Technology business, which itself has seen strong structural growth in recent years. Together, the enlarged business can offer additional technologies and added resources to consolidate its leadership in surface coating solutions and specialist processes, including thermal spray coating, liquid coating, thermal processing, and diffusion coating. Ellison’s operations will reportedly be fully integrated into Bodycote’s business model both from an operational and commercial perspective, and will operate going forward under the Bodycote brand.

“This acquisition continues our strategy to build our Specialist Technologies portfolio and enhance our exposure to the civil aerospace market,” stated Stephen Harris, Group Chief Executive of Bodycote plc. “Ellison’s business is one that we have respected for a long time and is a perfect strategic fit for Bodycote’s Specialist Technologies businesses.”

www.ellisonsurfacetech.com
www.bodycote.com

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Melrose estimates 20% drop in sales, announces return to productivity

On May 7, Melrose Industries PLC, UK, parent company of GKN Group, released a trading update for the four months from January 1, 2020, to April 30, 2020, and reported an estimated 20% sales decrease due to the impacts of the coronavirus (COVID-19).

The group stated that it had traded in line with expectations from January 1, 2020, until mid-March 2020, at which point the global impact from COVID-19 caused significant disruption, resulting in many factories being shut or remaining only partially open. As a result of these effects, the group’s sales for this period were down approximately 20% compared to the same period last year.

The group’s Automotive and Powder Metallurgy businesses have reportedly seen similar trading patterns to each other, with their factories in Europe and North America largely being shut since mid-March. Factories closed in whole or part during this period represented approximately 88% of the 2019 sales. All the group’s factories in China have now been open for several weeks and are seeing encouraging signs of a recovery in demand. There is also a steady process of factories being reopened in Europe and North America, albeit a gradual return with productivity affected by social distancing measures.

The group explains that management has taken significant actions to reduce the cost base of these businesses, and plans are being drawn up to position for the future. In both cases these businesses enjoy large market shares and strong customer relationships and the board believes significant opportunity exists to improve their performance. The net result of the above trading conditions in the period was that these two divisions combined had a sales decline of 31% compared to the same period last year.

Simon Peckham, CEO of Melrose Industries PLC, commented, “Our divisional management teams and head office employees have responded brilliantly to these unparalleled circumstances, which are likely to remain challenging for a while. During the next few months we will put in place plans to position our businesses to achieve their future potential in different market conditions. Melrose has a track record of managing its businesses successfully in all market environments and crucially our recent cash generation performance shows we have been able to maintain the strength of the balance sheet to position the group’s businesses in the best way for the future.”

www.melroseplc.net
Japan’s PM companies post full-year results for 2019–20

A downturn in overall PM production in Japan in 2019 is reflected in the declining sales of the major Japanese PM producers, which have now posted their full-year financial statements for April 1, 2019, to March 31, 2020. The declining sales are due to a general downturn in the global economy, particularly in the automotive sector, and have not yet included the impact of the coronavirus (COVID-19) pandemic on production and sales within Japanese companies.

Sumitomo Electric Industries Co Ltd (SEI), Itami, Japan, reported that total group sales for the financial year to March 31, 2020, were down by 2.3% to Yen 3,107 billion, compared with the previous year. Group operating income was down by 23.5% to Yen 127.2 million.

SEI operates a number of business segments, the third largest of which is its Industrial Materials & Others division. This division incorporates the production of cemented carbides (hardmetal cutting tools and wear resistant parts), PM parts and bearings, PM magnets, plus W, Mo, heavy metal, thermal management materials, ceramics, diamond tools and hardmetals produced at its wholly-owned A.L.M.T. subsidiary.

The division reported sales of Yen 331,350 billion for the financial year, down 7.4% year-on-year. Cemented carbide sales at SEI declined by 12.3% to Yen 93 billion. Sintered PM products decreased by 4% to Yen 74.8 billion, whilst sales at A.L.M.T. decreased by 16.9% to Yen 36.6 billion.

SEI acquired 100% of the shares of PM part producers Sinterwerke Herne GmbH (North Rhine-Westphalia, Germany) and Sinterwerke Grenchen AG (Canton of Solothurn, Switzerland) in May 2019. With these acquisitions, SEI will strive to expand its sales channels to cover European automakers and components manufacturers and increase the presence of its PM products business in Europe.

www.global-sei.com

Mitsubishi Materials Corp. (MMMC) reported group consolidated net sales down 8.8% year-on-year for the full financial year to Yen 1,516 billion, and an operating profit up 3.0% to Yen 37.9 billion. The group has production and sales in forty countries worldwide and overseas sales accounted for 44.4% of consolidated net sales.

The company operates in four business segments. The Advanced Products Business segment manufactures and sells copper processed products, electronic materials and aluminium products. The Metalworking Solutions Business segment manufactures and sells carbide products and sintered products, while the Metals Business segment is involved in the smelting and sale of copper, gold and silver, and the Cement Business segment produces cement, aggregate, ready-mixed concrete and concrete products.

Sales in the group’s Metalworking Solutions Business – which includes cemented carbide (hardmetal) tools, sintered products such as PM parts and PM bearings, high-performance alloy products and superalloys – decreased by 7.6% to Yen 665.0 billion. Cemented carbide sales and operating profit decreased as a result of declining sales both domestically and abroad, especially in China.

In the Sintered Products segment, which operates as Diament Corp, there was also a fall in sales. The segment reported a reduction in operating losses compared with the previous financial year, after having provided Yen 30.272 billion for restructuring of the loss-making Sintered Products business. Diament operates PM plants in Japan, Malaysia, Indonesia and China.

www.mmc.co.jp

Hitachi Chemicals Co Ltd, which includes two main business segments, Functional Materials and Advanced Components and Systems, reported that group sales for the year were down by 7.3% to Yen 631.4 billion, compared with the same period last year. Operating income was down 36.4% to Yen 23.1 billion.

The Advanced Components & Systems division, which includes sintered friction products, structural PM parts and PM bearings as well as vehicle batteries, printed circuit boards and diagnostic instruments, reported a 14.3% decrease in sales to Yen 388.2 billion with PM product sales down 10%. Hitachi Chemicals operates PM plants in Japan, the USA, Mexico, Indonesia, Thailand, Singapore and China.

www.hitachi-chem.co.jp

Fine Sinter Co Ltd, Kasugai, Aichi Prefecture, manufactures a wide range of Powder Metallurgy components for automotive applications, railroad vehicles and compact hydraulic equipment. Automotive products make up nearly 90% of the company’s sales.

The company reported that sales for the fiscal year 2019/2020 were down by just 0.5% to Yen 40.3 billion, compared with the same period of the previous year. The company saw operating income for the year decline by 25.8% to Yen 1.205 billion.

In addition to manufacturing facilities in Japan, Fine Sinter has manufacturing subsidiaries in USA, China, Thailand and Indonesia.

www.fine-sinter.com

Nippon Piston Ring Co Ltd (NPR), based in Saitama, Japan, manufactures PM products including piston rings and valve seats used in internal combustion engines, metal injection moulded parts and dental implants.

NPR reported sales of Yen 54,881 billion for the fiscal year to March 31, 2020, showing a drop of 3.8% on the previous year. Operating income was down 46.6% to Yen 1,829 billion. NPR has manufacturing facilities in Japan, China, Indonesia, India and the USA.

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www.kymerainternational.com
Sandvik reports decline in orders and revenues in Q1 2020 amid market uncertainty

Sandvik AB, headquartered in Stockholm, Sweden, has reported its results for the first quarter of 2020, showing an 11% decline in order intake year-on-year, and a decline in revenues of 7%. Customer activity is said to have developed in line with expectations during January and February, with the exception of an extended shutdown period of about one week in China after the Chinese New Year and the spread of coronavirus. Adjusted operating profit dropped by 18% and amounted to SEK 3,728 million and the adjusted operating margin declined to 15.8%. While cost measures are said to have been executed according to plan, they were not sufficient to offset the adverse impact of the negative year-on-year organic growth of -7%.

“In this challenging environment, I am pleased to see that our ongoing efficiency initiatives are progressing according to plan with 1.4 billion SEK achieved, out of the expected total of 1.7 billion SEK. I am also satisfied with the speed with which we have been able to identify and start implementing new savings initiatives to protect profitability going forward,” stated Stefan Widing, CEO and President of Sandvik, who assumed the senior role in February 2020.

“Each of the three business areas faced high comparables in the form of all-time-high order levels in the year-earlier period. Hence all three business areas noted declines in organic order intake and our overall order intake declined organically by 11% year-on-year. I am pleased to note that Sandvik Materials Technology’s strong product offering to the energy segment resulted in large orders amounting to 0.7 billion SEK in the period, supporting deliveries from this high value-added segment into next year.”

Sandvik Materials Technology
Organic orders declined by 14% year-on-year. Excluding the impact of large orders, order intake declined by 9%. Alloy prices had a positive impact of 1% on order intake and of 2% on revenues. Adjusted operating profit excluding metal price effects totalled SEK 340 million, yielding an underlying margin of 9%. Including negative metal price effects, adjusted operating profit decreased to SEK 139 million and the adjusted operating margin decreased to 3.7%.

The majority of the manufacturing footprint is concentrated in Sweden, and production in the first quarter was largely unaffected by COVID-19, it was stated.

Sandvik Machining Solutions
Order intake and revenues deteriorated year-on-year, with an escalating negative development in demand noted in the last week of March as the spread of COVID-19 intensified. A decline was noted in all major regions and all customer segments during the quarter. Adjusted operating profit amounted to SEK 2,054 million, decreasing 23% year-on-year. The adjusted operating margin declined to 21%.

In January and February, production was unaffected by COVID-19, apart from the extended stoppage of about one week in China. Supply and distribution chains remained largely intact throughout the quarter. However, a sharper drop in demand was recorded in the last week of March, with large customer segments impacted by production stoppages.

Sandvik Mining and Rock Technology
Total order intake declined organically by 8% from the all-time-high level reported in the preceding year. Increased hesitancy in customer decision-making processes was noted toward the end of the quarter as COVID-19 escalated.

Operating profit decreased by 9% year-on-year, primarily due to the negative impact from changed exchange rates, but also due to lower organic revenues. The operating margin declined to 17.0%.

During the quarter, production was impacted only to a minor extent, and both supply and distribution proceeded as planned. The majority of the business area’s production footprint is Europe-based.

www.home.sandvik

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**Carpenter Technology to idle two powder production facilities**

Carpenter Technology Corporation, headquartered in Philadelphia, Pennsylvania, USA, has stated it plans to idle two of its US-based metal powder production facilities, as the company reacts to the COVID-19 pandemic and an oversupply of titanium powder in the market.

However, as stated by Tim Lain, Carpenter’s Vice President & Chief Financial Officer, during the company’s third quarter 2020 results conference call, Carpenter has no plans to exit the metal powder market. “We remain committed to a metal powder production, but consider it necessary to close these two facilities to save cost and preserve cash flow in the near term,” he commented.

The sites affected, reported to be Rhode Island and West Virginia, are set to close in the next quarter.

During a Q&A session in the conference call, Tony Thene, CEO, added, “Unfortunately when we brought online our West Virginia facility there were many others that brought on titanium powder capacity, so that is in an oversupply position right now.”

“We can still offer a full portfolio to customers,” Thene confirmed during the conference call.

The company also announced plans to exit the downstream oil and gas (Amega West) business. “We expect that the actions to exit the Amega West business and idle the two powder facilities will generate estimated annual savings of $15 million to $20 million based on the current run rates for these businesses,” added Lain.

www.carpentertechnology.com

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**Auto components maker purchases series of Ipsen Furnaces**

Ipsen USA, Cherry Valley, Illinois, USA, has received an order for two TITAN® H6 2-bar vacuum furnaces this week from what it describes as a rapidly emerging global automotive component manufacturer, with locations in the United States and Asia.

“Despite general market conditions at the present time, we are seeing many forward-looking manufacturers continuing to invest in efficient, high-performance systems for the future,” stated Patrick McKenna, Ipsen USA’s President and CEO.

The customer placed this order as part of a series of orders for eight furnaces, all provided by Ipsen, over the last two years. Ipsen’s TITAN was said to be the customer’s preferred choice due to its process flexibility and ease of installation, as well as the regional support provided by Ipsen’s sales and service teams in both the USA and Asia.

www.ipsenusa.com

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- Maximal machine utilization
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GFMS, System 3R Int’l AB, Sorterargatan 1, S-162 50 Vällingby, Sweden,
e-mail: info.system3r@georgfischer.com, www.system3r.com
Miba posts stable financial year despite global slowdown

Miba AG, Laakirchen, Austria, reports it has demonstrated stable development in the fiscal year 2019–2020 (1 February 2019 to 31 January 2020), despite a significant slow-down of global economic growth and a pronounced decline in some markets, such as the automotive sector. The company’s annual revenue was €977 million, a decline of 0.8% compared to its record figure of €985 million in the previous year.

The company states that it generated 53% of its revenue in the industrial goods business and 47% in the automotive sector. F Peter Mitterbauer, Miba CEO, commented, “The past business year once again has clearly shown that the market risk is less for Miba with its broad product portfolio than for companies catering to only one customer segment.”

According to Miba, the traditionally high equity ratio is an important enabler for Miba’s financial stability. It was 49% in the past fiscal year. Mitterbauer added, “This provides us with the financial independence and security which make it possible for us to steer the company on a steady course and with a sure hand, also in hard times. Thus we are well-positioned to successfully master the challenges that we will have to face in the coming months.”

Mitterbauer explains that it is also making use of the Austrian short-time work scheme to cope with the situation. “This scheme ensures our flexibility to respond to sales shortfalls by reducing working hours, while at the same time allowing us to continue production for existing customer orders.”

Additionally, Mitterbauer states that providing financial support to employees in need during COVID-19 is a priority. “We as the Miba family proprietors set up a Mitterbauer Emergency Fund endowed with €500,000 for the benefit of employees who have lost income and are in serious financial difficulties as a result of the COVID-19 crisis. Employees will not have to repay this financial relief.”

The stable and sustainable development of Miba over the past few years has reportedly not only put the company in a position to successfully master the challenges ahead, it has also prepared the ground for its long-term development.

Mitterbauer concluded, “Decarbonisation and digitisation – these two megatrends will stay with us also after the coronavirus crisis. We intend to make a proactive contribution to shaping these megatrends with our technologies contributing to sustainable, CO₂-reduced production, transmission, storage and use of energy. By developing new digital products and services we will provide our customers with true added value.”

www.miba.com

Umicore reports growth in 2019

Global materials technology and recycling group Umicore, headquartered in Brussels, Belgium, has published its 2019 Integrated Annual Report which reports that the group’s revenues for the full year grew by 3% to €3.4 billion and recurring EBITDA increased 5% to €753 million, while recurring EBIT was €509 million, close to the record levels of 2018.

Umicore states that its performance in Energy & Surface Technologies was well below the record levels of 2018 due to a temporary market slowdown as well as the impact of depressed cobalt prices and competition from unethically sourced cobalt from artisanal mining. In addition, the performance reflected higher depreciation charges and upfront costs related to its greenfield investments.

The 2019 report continues to focus on the elements that drive Umicore’s business and this year includes expanded content on innovation, on the group’s sustainable products and services, as well as on human rights and Umicore’s role and mission in the value chain. The report also includes Umicore’s response to the COVID-19 pandemic: to keep people healthy, to ensure safe working conditions and to preserve cash. With a strong balance sheet and ample liquidity, Umicore expects to emerge from the crisis ready to resume its growth trajectory.

“In 2019 we posted a strong performance in a challenging market environment and made significant strides in the execution of our growth strategy in all three major activities, while again reaching the original financial target of our Horizon 2020 strategic plan,” stated Marc Grynberg, CEO, Umicore. “We signed multi-year agreements with leading EV battery producers and concluded long-term supply partnerships for sustainable cobalt. We commissioned our new Process competence center in Belgium and a fuel cell catalyst plant in Korea, and acquired the Kokkola cobalt refinery in Finland. We contributed to the creation of a sustainable and innovative battery value chain for EVs in Europe and were instrumental in the clear sustainability principles for the rechargeable battery industry issued by the Global Battery Alliance. Technology innovation and our ongoing growth investments promise further value creation once the current pandemic is behind us.”

www.umicore.com
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Products Include
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  ~dendritic
· Copper alloys
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· Press-ready premix bronzes
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· Speciality powders

GRIPM Advanced Materials Co., Ltd., in Beijing, China, since 2004 (former factory from 1997), held by GRINM Group Co., Ltd (a Chinese national corporation group since 1952)
Annual capacity: > 30000MT
FIVE subsidiary companies, including Makin Metal Powders (UK) Ltd.

Makin Metal Powders (UK) Ltd has achieved its current position as one of the leading Copper and Copper Alloy powder producers in Europe by supplying the powders that match customer technical specifications in the most cost effective manner on a consistent basis.
BASF, Ludwigshafen, Germany, has signed a cooperation agreement with Fortum, a leading clean energy company located in Harjavalta, Finland, and Norilsk Nickel (Nornickel), a diversified mining and metallurgical company based in Moscow, Russia, to develop a battery recycling cluster in Harjavalta, which will serve the electric vehicle market. It is believed that the cluster will enable a successful closed-loop cycle to reuse the critical metals present in used batteries.

Using metals from recycled batteries to produce battery materials offers significant CO$_2$ reductions in the production of electric vehicles. Additional CO$_2$ reductions can be achieved by using electricity from renewable sources in Finland for the recycling process.

BASF intends to use recycled materials from the processes developed by the companies within this cooperation in its planned battery materials precursor plant in Harjavalta, which was established in 2018. The parties aim to foster the production and use of responsibly produced recycled raw materials in the battery market.

“By recycling valuable metals in lithium-ion batteries we reduce the environmental impact of electric car batteries by complementing the supply of cobalt, nickel and other critical metals from primary sources,” stated Tero Holländer, Head of Business Development, Fortum Recycling and Waste. “Through our previous acquisition of a Finnish growth company Crisoluteq, an expert in low CO$_2$ hydrometallurgical processing, we are very proud that Fortum is now able to increase the recovery rate of valuable materials in lithium-ion batteries from 50% to over 80%.”

Tim Ingle, Vice President, Precious Metals Refining, Chemicals & Battery Recycling, at BASF, stated, “The combination of battery materials production and recycling enables the circular economy by closing the loop. To drive electrification, we are focused on bringing solutions for high energy density cathode active materials and high-efficiency lithium extraction for battery recycling.”

Joni Hautojärvi, Managing Director, Nornickel Harjavalta, explained, “A modern recycling unit next to Nornickel Harjavalta would further strengthen its position as one of the most sustainable nickel refineries in the world. This setup is ideal for sustainable processing of two of the main metals used in Li-ion batteries. Development of recycling solutions will not only support Nornickel’s strategy of further lowering its CO$_2$ footprint and improving sustainability, but it is also essential to enable the industry to meet the growing demand of critical metals in the electric vehicle sector.”

www.basf.com
www.fortum.com/batterysolutions
www.nornickel.com
H.C. Starck Tantalum and Niobium renamed TANIOBIS

H.C. Starck Tantalum and Niobium GmbH, Goslar, Germany, will do business under the name TANIOBIS from July 1, 2020. The rebranding follows the company’s purchase by Japan-based JX Nippon Mining & Metals in 2018 from original owners H.C. Starck GmbH. The company’s branches and production sites in Germany (Goslar, Laufenburg), Japan (Tokyo, Mito), Thailand (Map Ta Phut) and the USA (Needham, Massachusetts) will continue to operate as usual under the new name.

H.C. Starck Tantalum and Niobium, now TANIOBIS, has sixty years of experience manufacturing materials on the basis of tantalum (Ta) and niobium (Nb), and processes these ores into high-performance powders tailored to customer needs.

“Our new name is a combination of the two key raw materials used in our production operations, tantalum and niobium,” stated Masakazu Kanzaki, the company’s Vice Chairman & CEO. “The characters ‘i’ and ‘s’ at the end stand for ‘innovative solutions’. That’s our personal promise of quality to our customers, underscoring the central role of innovation in our future approach.”

www.hcstarck-tantalum-niobium.com

Toyota and Honda ramping up Chinese production to accelerate recovery

Japanese auto companies will accelerate production in China from May, reports Nikkei Asian Review, as the country recovers from the coronavirus (COVID-19) pandemic. Toyota Motor and Honda Motor will each reportedly increase manufacturing by 10% in May, compared to the same month in 2019.

This increase in production levels is expected to help make up for manufacturing capacity lost during factory shutdowns earlier this year. Toyota operates four Chinese assembly plants, accounting for just under 20% of its global production. In February, its Chinese sales saw a 70% reduction due to lockdown, but recovered in April to exceed figures from April 2019.

“Demand for vehicles is surging as Chinese consumers prioritise safety,” stated a Toyota executive in Nikkei Asian Review. “The recovery is quite astonishing.”

It was also reported that Nissan Motor will increase production, but its manufacturing levels will remain 20% lower than those of May 2019. German automakers are also seeing recovery in China, with Daimler and BMW said to have recovered to a level only 7% and 13% lower than their levels at the same time in 2019. Volkswagen announced its sales were 36% lower in March, but reopened all dealerships in April.

www.toyota-global.com | https://global.honda/
Sandvik achieves AS9100D aerospace certification for titanium and nickel-base superalloy powders

Sandvik AB, headquartered in Stockholm, Sweden, reports that its new powder plant for titanium and nickel-base superalloys has received AS9100 Revision D certification for deliveries to the aerospace industry.

The powder plant for Osprey® titanium and nickel-base superalloys was officially opened at the end of 2019 in Sandviken, Sweden. Since then, extensive work has been ongoing to ramp-up the highly automated plant, fine-tuning all processes and qualifying the powder to ensure the best possible consistency, morphology and quality. The first two titanium powders produced at the plant are Osprey® Ti-6Al-4V Grade 5 and Osprey® Ti-6Al-4V Grade 23. The nickel-base superalloys are Osprey® Alloy 625 and Osprey® Alloy 718.

“Having atomised fine metal powders for more than forty years, and supplying titanium to the aerospace industry since the 1980s, Sandvik is no stranger to powder atomisation or the requirements of the most demanding industries,” stated Keith Murray, Vice President of Global Sales, Sandvik Additive Manufacturing.

“Now we are one of few companies that has the new and prestigious AS 9100D quality certification for our Osprey titanium powder and nickel-base superalloys used for Additive Manufacturing. It is a true milestone, which will facilitate many customer collaborations going forward.”

In addition to a shift towards sustainable manufacturing, Sandvik explains that traceability is of vital importance in the aerospace industry, the company can offer traceability for its titanium powder, which is made possible by having the full supply chain inhouse – from titanium sponge to finished powder.

The new titanium powder process uses advanced electrode inert gas atomisation technology to produce highly consistent and repeatable titanium powder with low oxygen and nitrogen levels. The automated production process is also supported by several industrial robots and a dedicated downstream sieving, blending and packing facility.

“Our highly automated manufacturing process ensures excellent consistency – and the powders demonstrate optimal particle size distribution,” Murray concluded.

www.additive.sandvik

Formnext 2020 remains on course for November event, with digital options if required

Mesago Messe Frankfurt GmbH, the organiser of Formnext, reports that it still expects the event scheduled to take place in Frankfurt, Germany, from November 10–13, 2020, to go ahead. The organiser also states that it is working on a concept for safeguarding the health of attendees and a supplementary digital programme.

“We remain convinced of the unique value and advantages of a physical exhibition,” explained Sascha F Wenzler, Vice President of Formnext, Mesago Messe Frankfurt GmbH. “And although digital interaction will never be able to replace face-to-face contact, it does offer more scope than previously thought possible only a few weeks ago.”

It is for this reason that the organiser intends to consider digital options for Formnext, for example, exhibitors will also be given the opportunity to present products and solutions digitally to the international trade audience. Concepts and platforms are currently being developed for this purpose with further details to be released in the coming weeks.

According to the organiser, the rulings of the Federal Government and the Federal States of Germany, dated May 6 2020, stating that trade shows are no longer considered to fall under the category of major events that pose a particular health risk, also give cause for optimism for the event to run as planned in November.

Wenzler added, “This is great news not only for the trade show industry, but for the entire economy. Trade shows are an important driver of innovation and value creation in industry, especially after months of economic standstill in many industries and sectors.”

The organiser explains that the health of exhibitors, visitors and employees remains a top priority, therefore, concepts are currently being developed to ensure the highest standards of health protection. These include reducing visitor density, guaranteeing high hygiene standards and introducing contact tracing. These concepts are currently being coordinated with the responsible authorities and will be duly implemented in due course.

In addition to health protection, Formnext 2020 is reportedly being designed in consideration of a number of other important factors, such as the wider economic environment, the economic situation in the AM sector, and developments in the European and global travel industry.

“Ultimately, even in these challenging times, we want to organise a trade show that is as responsive as possible to the current situation and the needs of participants and the market,” concluded Wenzler.

www.formnext.com
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We take pride in educating our customers. See how DSH can help you today.
New dates for PM China 2020

The 13th International Exhibition for Powder Metallurgy, Cemented Carbides and Advanced Ceramics (PM China 2020), organised by Uniris Exhibition Shanghai Co., Ltd, has been moved to August 12–14, 2020, following the coronavirus outbreak. Originally set to take place at the Shanghai World Expo & Convention Center, from March 24–26, 2020, PM China 2020, over 500 organisations are reported to have reserved booths at the event.

“We once again apologise for any inconveniences caused to you by the postponement and are sincerely grateful for your kind understanding and continual support. We look forward to seeing you on August 12–14, 2020, at Shanghai World Expo Exhibition Center,” it was stated.

http://en.pmexchina.com/

EU’s new harmonised classification for cobalt metal announced

The Cobalt Institute, a non-profit trade association composed of producers, users, recyclers, and traders of cobalt based in Guildford, Surrey, UK, has reported the EU’s updated harmonised classification rules for cobalt metal, including a temporary Generic Concentration Limit (GCL) of ≥ 0.1 %.

The new rules entered into force on March 9, 2020, and will start to apply from October 1, 2021. The cobalt industry is reportedly working with its downstream users to ensure an effective implementation of the new harmonised classification.

According to the Cobalt Institute, it believes that EU regulation should focus on the established hazard concerns linked to the inhalation of cobalt metal. However, despite existing data reportedly indicating the safety of dermal and oral exposure to cobalt metal, the new harmonised classification is not limited to inhalation. As a consequence, the cobalt industry plans to invest significant additional resources to generate new scientific evidence to conclusively prove that cobalt metal can be used safely once exposure via inhalation is controlled.

The Cobalt Institute explains that it welcomes the European Commission’s recognition, through the temporary GCL, of the need to further refine the methodology for deriving concentration limits for inorganic materials such as cobalt metal. The association encourages the EU and member state authorities to continue to engage in the expert group which has been established to review this methodology under the European Chemicals Agency. In the meantime, the CI reports that it will be important in its view to maintain the current GCL, the appropriateness of which it is confident will be confirmed by the ECHA review.

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- Modular device in accordance with Industry 4.0.
- Software adjustable to the specific needs of the technological process.
- Multipoint temp. measurement.
- Manual, semi or automatic process control.

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### JFE Steel develops FM800 nickel-free alloyed steel powder

JFE Steel Corporation, headquartered in Tokyo, Japan, states that it has developed a nickel-free alloyed steel powder known as FM800. The new powder is said to offer 800 MPa-class tensile strength when sintered in a mesh-belt furnace, making it suitable for numerous Powder Metallurgy applications.

FM800 is an alloyed steel powder that is prealloyed with 3% copper and 1.3% molybdenum. Whereas prealloying with alloy elements can reduce the compressibility of powder, the company states that it has successfully achieved higher compressibility by controlling the production process. FM800’s advantages are expected to be utilised for the manufacture of automotive and construction equipment parts.

Conventionally, alloyed steel powder containing 4% nickel, 1.5% copper and 0.5% molybdenum is used for these parts, but not without problems. Typically, a significant drop in post-sintering hardness reduces machinability and increases processing costs, and susceptibility to fluctuations in the market price of nickel.

To address these issues, JFE Steel has been offering its FM Series of nickel-free alloyed steel powders that reportedly enable customers to enhance product quality as well as cut costs. The FM Series includes FM600, which offers 600 MPa-class tensile strength when mesh-belt sintered; FM1000, which achieves 1,000 MPa-class tensile strength after carburisation; FM1000S, which boasts extra toughness in addition to the properties of FM1000; and FM1300, which is heat-treated after high-temperature sintering to achieve superb tensile strength of 1,300 MPa.

According to JFE Steel, in the case of 800 MPa-class tensile strength, however, nickel-free alloyed steel powder previously had to undergo carburisation heat treatment, but the corporation’s development team has been able to eliminate this step to help customers reduce costs. JFE Steel is believed to be Japan’s only manufacturer of a total range of iron powders, including reduced-iron powder, atomised-iron powder and alloyed-steel powder.

www.jfe-steel.co.jp

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Shining 3D launches automatic desktop 3D inspection system

Shining 3D Tech. Co., Ltd., Hangzhou, China, has launched AutoScan-Inspec, an automatic desktop 3D inspection system capable of integrating high-accuracy 3D scanning and 3D inspection, designed to improve the efficiency of scanning small and complex parts.

The system has a number of applications, including for non-contact measurement, inspection and quality control, reverse engineering and product design.

Featuring an intuitive user interface and AI scanning algorithm, the company states that the system enables automatic and full-size inspection. It is said to enable users to efficiently collect 3D data from small samples, saving valuable time.

AutoScan-Inspec’s features include:

- **Metrology-grade accuracy**
  Advanced blue-light 3D scanning technology is said to provide users with scan accuracy within 10 μm to ensure the high level of accuracy required for quality inspection.

- **Fine detail**
  The system is said to offer precisely detailed 3D scans for small and complex objects using its 5-megapixel dual-camera.

- **Automatic scanning**
  The system features 3 axes for multi-angle scanning, enabling users to obtain 3D scans quickly and easily.

- **Powerful software**
  The system comes with Shining 3D’s Ultrascan software, said to be specially developed for industrial application with a user-friendly interface and easy operation. Using the software, 3D data generated by AutoScan-Inspec can be exported easily to CAD/CAM systems such as Geomagic Control X, Design X, Zbrush, Polyworks, etc.

www.shining3d.com

Asbury Carbons’ CEO Stephen Riddle steps down

Asbury Carbons, headquartered in Asbury, New Jersey, USA, recently reported that its CEO, Stephen Riddle, has stepped down effective February 25, 2020. Riddle was the fourth generation of the Riddle family, who founded Asbury Carbons as Asbury Graphite Mills in 1895, to work at the corporation and served as CEO from January 2011.

“Stephen was a fixture at Asbury Carbons, building industry relationships and serving in many roles. We thank him for his four decades of dedicated service,” stated Stan Tilton, Chairman of Asbury Carbons Board of Directors. “While we will miss Stephen’s day-to-day influence, he remains a Director and significant Shareholder. The Board of Directors is confident that Asbury has a strong leadership group supporting a capable and dedicated global team engaged in the execution of our strategic plan.”

The company states that the Board of Directors has no plans to immediately fill the position and plans to shift responsibilities to Noah Nichelson, President of Asbury Carbons in coordination with the Asbury leadership team. Established in 1895, Asbury Carbons is a supplier of quality carbon and graphite products for use in a wide range of applications including Powder Metallurgy. According to the company, beyond its ISO certifications, multi-faceted quality checks and proven ability to keep its customers’ supply chain moving, it is committed to using its extensive range of research, technical and manufacturing capabilities to craft smart-engineered solutions for unique needs.

Asbury Carbons currently offers nearly 3,000 grades of materials, sourced from its global network, engineered by top scientists, and delivered seamlessly to customers from its facilities including the USA, Mexico, Canada, Europe and Asia.

www.asbury.com

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Abbott Furnace explains how to return furnace systems to operation following downtime

Abbott Furnace Company, St. Marys, Pennsylvania, USA, has issued advice on important steps for furnace operators to consider to ensure a successful return to operation for equipment that has been turned off for a period of time, reports ASM International. The recommended steps for returning furnace systems to operation include:

1. Reference the manufacturer supplied manual for specific information regarding the re-starting of the equipment.
2. Be sure that water is flowing to all of the cooling chambers of the furnace.
3. Check that the belt is on and moving smoothly through the furnace. Watch for jerking or jumping of the belt that would indicate an issue with the drive or pathway through the furnace.
4. Enable the ramp mode in your controls to limit the heating rate of each zone to 55°C (100°F) per hour or less. If the furnace does not have a ramp mode, be sure to manually adjust the set-points of each zone to ensure it does not exceed the suggested ramp rate.
5. Once the furnace reaches 150°C, purge the furnace with nitrogen and allow the nitrogen to flow as the furnace continues to heat up.
6. When the zones of the high heat section of the furnace are above 760°C, combustibles may be introduced and the furnace can continue to be ramped to the final processing set-points, once the pilots are ignited.
7. Allow the furnace atmosphere to re-condition the furnace, clean the belt, and stabilise. A little trick – loading scrap metal that is free of oils, grease, and rust will help the furnace to ‘clean up’ and stabilise.

Abbott Furnace Company is an industrial furnace manufacturer with over thirty-five years of experience designing and producing industrial continuous furnaces. It is also a producer of industrial sintering furnaces, annealing furnaces, tempering furnaces, brazing furnaces, heat treat furnaces, steam treat furnaces, industrial ovens, and specialty furnace products.

www.abbottfurnaceco.com

QuesTek enters joint venture agreement with Itochu Techno-Solutions

QuesTek Innovations LLC, Evanston, Illinois, USA, has entered into a joint venture agreement with Itochu Techno-Solutions (CTC), Tokyo, Japan. The new joint venture is called QuesTek Japan K.K., and has been established to better serve its Japan-based customers.

CTC provides sales and consulting services for a range of materials-related software products, including those for alloy design, materials process design, materials characterisation and related databases, while providing support and consulting services. Founded in 1972, CTC reported sales in the last fiscal year of over $4.1 billion and has 8,600 employees worldwide.

QuesTek specialises in Integrated Computational Materials Engineering (ICME) technologies. Its Materials by Design® methodology combines physics-based models, vetted thermodynamic and kinetic databases of the elements and predictive property models to allow for efficient materials design, process optimisation, modelling and simulation. A recent example of QuesTek’s application of ICME is the development of the first high-temperature aluminium alloy for use with Additive Manufacturing.

Dr Greg Olson, QuesTek’s Chief Science Officer and Massachusetts Institute of Technology Thermo-Calc Professor of the Practice, commented on the formation of the joint venture, "With more than thirty years of experience in Japan’s technology markets, CTC is well-positioned to be a strong partner for QuesTek. As a lead up to this joint venture, we’ve worked closely with CTC and have found them to have the technical skills, the market knowledge, relationships and track record to be the ideal partner for us in Japan."

www.questek.com
www.ctc-g.co.jp
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www.globaltungsten.com
SAIC Motor subsidiary launches €64 million fuel cell project in Shanghai

Shanghai Hydrogen Propulsion Technology Co., Ltd. (SHPT), a subsidiary of SAIC Motor, has launched a new fuel cell project in Jiading District, Shanghai, which is expected to help SAIC Motor accelerate the industrialisation of fuel cell-related products, reports autonews.gasgoo.com.

As part of the project, the company plans to invest RMB 500 million (€64 million) in the construction of a new facility, Jiading Hydrogen Park, a fuel cell-focused base for R&D business administration, product test & verification, pilot scale production and the supply of hydrogen energy, according to a post on SHPT’s WeChat account. The first phase is reportedly scheduled to begin operation in August 2021, with an annual capacity of 12,000 sets of fuel cell stack and system. The project is anticipated to output value of RMB 1.2 billion (€155 million) by 2024.

SHPT was established in 2018 to accelerate the commercialisation and industrialisation of fuel cell-related products for SAIC Motor. It provides fuel cell products and engineering services for vehicle manufacturers and is said to have completed the development of several types of fuel cell stacks and systems, with power levels ranging from 30 kW to 100 kW and above. It mainly serves SAIC-owned brands such as Roewe, Maxus, Sunwin, Hongyan and Naveco.

www.shpt.com | www.saicmotor.com

Global pandemic impacts automobile industry figures

With the global automotive industry affected by the coronavirus (COVID-19) pandemic, manufacturers are facing several more months of disruption in sales and production. LMC Automotive, a leading forecaster based in London, UK, has stated that it expects the sharp fall in vehicle sales in the first quarter of 2020 to bottom out in April in North America and Europe. China, it said, has restarted production in most of its automobile plants.

LMC Automotive is projecting a fall of more than 20% in global light vehicle production to around 71 million units in 2020 as a result of the COVID-19 pandemic and ensuing recession. This steep decline is expected to cost global automakers around 19 million units in lost production and this would inevitably also impact component suppliers.

In the first quarter of 2020 sales of new cars in the EU and EFTA declined by 27.1% to 2.764 million units with the impact of the COVID-19 crisis weighing most heavily on the March sales figures. Each of the major EU markets posted significant losses: Italy reported -35.5%; France reported -34.1%; Spain reported -31%; and UK reported -31%. Car production in Germany, Europe’s largest car market, fell by 21% in the first quarter to 1.017 million units. European demand for cars in 2020 has been downgraded to 15.6 million units, down by 13.6% over 2019. This represents a volume downgrade of 1.9 million units versus pre-coronavirus estimates. In the USA, demand for light vehicles plummeted in March by 38.6% year-on-year with 982,953 units sold. First quarter sales were down overall by 11.9% at 3.512 million and Canada ended the quarter down 20.8% at 329,645 units.

China, which was among the first countries hit by COVID-19, saw the first quarter of 2020 vehicle production and sales volume reach 3.47 million (-45.2%) and 3.67 million units (-42.4%), respectively from the previous year. China is the world’s largest car market and with the resumption of production in many car plants in April, the sector is expected to rebound in the Q2, although it is unlikely to achieve the levels of the same period in 2019. China expects an overall sales decline of 12% in 2020, according to LMC Automotive.

Japan’s automotive industry ended the first quarter of 2020 better than expected, with vehicles sales down 9.3% to 1.375 million. Bucking the trend, the Korean Ministry of Trade, Industry and Energy announced that Korea’s auto production and domestic vehicle sales in March increased by 6.8% (369,165 units), and 10.1% (172,956 units), respectively. This was after a 26.4% fall in total vehicle production in February to 189,235 units, attributable mainly to the shortage of auto parts from China and the temporary shutdown of production lines.

www.acea.be | lmc-auto.com
Manufacturing slowdown and coronavirus impact metal prices

The global slowdown in manufacturing output, which started in the second half of 2019, and the more recent rapid spread of the coronavirus (COVID-19) around the world, has negatively impacted many key industries. The coronavirus in particular has forced many manufacturing industries in the leading economic countries to cut output leading to reduced demand for raw materials such as metals. This in turn has led to a downward pressure on metal prices since the beginning of 2020.

The London Metal Exchange (March 24) reports that the base price for copper dropped by 22% to $4,769/tonne compared with $6,188 at the beginning of the year. The price of nickel has fallen to $11,033/tonne from $14,140/tonne; zinc was down to $1,830/tonne from $2,276; lead down to $1,644/tonne from $1,906/tonne; and tin was down 22% to $13,250/tonne from $17,140/tonne. According to the LME, molybdenum metal recorded a drop to $8.7/lb on March 24 from $9.65/lb a month earlier, and cobalt saw a more modest drop to $29,000/tonne compared with $33,000/tonne.

The tungsten news website, Chinatungsten, reported that there had been only a slight downward movement in the prices of tungsten powder and tungsten carbide powder. Tungsten powder was quoted at $31.60/kg on March 24, 2020, compared with $34/kg a month earlier. Tungsten carbide powder was quoted at $31.30/kg compared with $33/kg in February. Many of the Chinese tungsten concentrate and ammonium para-tungstate (APT) producers were either unable to operate or were run at very low operational levels in February and most of March due to coronavirus. China produces some 80% of the global demand for tungsten-based raw materials.

China also produces around half of the world’s production of all base metals and 56% of steel (in 2019). It is reported that with the coronavirus effectively under control in China, insiders are optimistic that the Chinese economy will start to recover in the second quarter of 2020 and in the second half of the year. However, how the rest of the global economy will cope with the ongoing virus situation is still very unclear.

https://lmc-auto.com/
http://news.chinatungsten.com/
https://agmetalminer.com/
Fraunhofer IFAM and partners to develop brake pads without Cu or Ni

The Fraunhofer Institute for Manufacturing Technology and Advanced Materials (IFAM) reports that it is collaborating with brake pad and friction solutions specialist SBS Friction A/S, Svendborg, Denmark, and the Danish Technological Institute, to develop an iron-based sintered brake pad for motorcycles as part of the ‘Green Pad’ project. Supported by the Innovation Fund Denmark, the project seeks to create an environmentally friendly alternative to established surfacing materials.

The aim of the research project is to develop copper- and nickel-free sintered brake pads with tribological properties equivalent to those of conventional metal brake pads. Initial tests have shown that the new iron-based developments are achieving promising results, which have been demonstrated both in the laboratory and in use in a motorcycle.

Sintered brake pads are superior to organically bonded pads due to their high temperature resistance, as well as their properties with regard to wear, abrasion and coefficient of friction, and are often used for high-performance brakes in rail transport and motorcycles.

Currently, there are said to be no environmentally friendly metal alternatives. However, the institute states that there are clear commercial, economic and environmental reasons for abolishing the use of copper and nickel in production, and these driving forces will become stronger as stricter legislation is implemented.

It is for this reason that Fraunhofer IFAM believes new solutions for metal sintered brake pads are urgently needed. New solutions for metal brake pads are also required for environmental reasons, because brakes for high-performance applications are generally copper-based, which is considered to be highly toxic to aquatic species.

The institute states that from 2021, brake pads with a copper content of more than 5% will no longer be allowed to be sold in the US states of Washington and California, and by 2025 brake pads must be almost completely copper-free, with a maximum content of 0.5%.

Considering the motorcycle market as a whole, the use of copper- and nickel-free products could potentially reduce copper emissions by 600 tonnes per year. This is equivalent to approximately 25% of the emissions from copper brake wear throughout Europe. For nickel, the potential savings are 160 tons per year. These effects become even greater when additional target segments such as racing cars, scooters, high-quality mountain bikes, ATVs and industrial machinery are taken into account.

In addition to tribological tests, material developments for all tribological applications and the optimisation and design of friction pairings, tribological damage cases are also assessed at the institute.

www.ifam.fraunhofer.de
www.sbs.dk | www.dti.dk

Rapidia opens US facility, targets prototyping of PM components

Rapidia Inc, headquartered in Vancouver, British Columbia, Canada, has opened a new US facility in Innovation Park, just outside Chicago, Illinois, to showcase its Additive Manufacturing technology and serve its US customers. The Rapidia system uses a water-based metal paste AM process to produce parts in a range of materials, including stainless steel, Inconel, and ceramics.

The two-stage office friendly system consists of a metal printer and a sintering furnace. The use of water, instead of a typical binding element, eliminates a solvent-based debinding step and is said to result in a fast, simple to use system that is environmentally friendly and completely solvent-free.

In addition to the growing Additive Manufacturing markets, the company sees the prototyping of Powder Metallurgy components as an ideal application for its technology. Using the Rapidia system, those in the PM industry can produce prototype metal components in under twenty-four hours.

Rapidia also announced the appointment of Tim Ruffner as its new Head of North American Sales. Ruffner has a background in Additive Manufacturing, having previously worked for Desktop Metal, Concept Laser, Rize, and Dynamism.

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U.S. Department of Energy grants $28 million funding for R&D on Ultra-high Temperature Materials

The U.S. Department of Energy has announced up to $28 million in funding for a new Advanced Research Projects Agency-Energy (ARPA-E) programme called ULTrahigh Temperature Impervious Materials Advancing Turbine Efficiency (ULTIMATE), reports the Metal Powder Industries Federation (MPIF). The programme will reportedly develop and demonstrate ultra-high temperature materials that can operate in the high-temperature and high-stress environments of a gas turbine blade. Projects will specifically target gas turbine applications in the power generation and aviation industries.

According to the DOE, gas turbines are used for a variety of applications, from aerospace engines to industrial power generation, and natural gas turbines currently produce an estimated 35% of the electricity generated across the USA. Improving turbine efficiency is expected to create opportunities to generate more energy savings, lower carbon emissions, and benefit the economy in these sectors as well as across a range of other sectors.

The ULTIMATE programme aims to improve the efficiency of gas turbines by increasing the temperature capability of the materials used in the most demanding environments, such as the turbine blade. The temperature capability of current state-of-the-art blade materials has improved steadily over the last few decades to 1100°C, through incremental microstructure and chemistry refinement.

However, there exists a new opportunity to discover, develop, and implement novel materials that work at temperatures significantly higher than industry standard superalloys, to further increase efficiency and economic gains.

ULTIMATE projects will reportedly address this need by developing novel ultra-high temperature metal alloys and coatings integrated with advanced manufacturing processes. The ULTIMATE programme will target enabling gas turbines blades to operate continuously at 1300°C in a material test environment or with coatings, with turbine inlet temperatures of 1800°C or higher.

“Gas turbines are a major generator of electricity, and have significantly contributed to the cleaner generation of electricity over the past several years,” stated Mark W Menezes, Under Secretary of Energy. “Developing new, innovative technologies under the ULTIMATE programme will allow us to better utilise gas turbines across multiple power sectors, from electricity generation to transportation and aviation, making all of these industries more efficient.”

Lane Genatowski, ARPA-E Director, added, “The development of novel ultra-high temperature alloys in conjunction with coatings and advanced manufacturing will help to increase the efficiency of our nation’s power generation and aviation industries. Enabling turbines to operate at higher temperatures for longer sustained periods will result in significant reductions of both wasted energy and carbon emissions across many crucial power generation applications.”

www.energy.gov
www.arpa-e.energy.gov

Kennametal named a gold winner in 2020 Edison Awards

Kennametal Inc., Pittsburgh, Pennsylvania, USA, has received a gold Edison Award in the Metal Production subcategory of the award’s Applied Technology category, for its HARVI™ I TE metal cutting end mill. Originally established in 1987, the Edison Awards have recognised some of the most innovative products and business leaders in the world, honouring excellence in new product and service development, marketing, design and innovation.

The HARVI I TE solid carbide end mills are reported to set new performance standards in metal milling, a key manufacturing technique that typically requires multiple tools.

“Kennametal won a gold Edison Award for its HARVI™ I TE high performance metal cutting end mill (Courtesy Kennametal)”

“This gold Edison Award for our new HARVI™ I TE end mill is the latest proof point in Kennametal’s rich history of innovation in metal cutting,” stated Carlonda Reilly, Vice President and Chief Technology Officer, Kennametal. “We are honoured to be recognised by the Edison Awards for our ongoing commitment to developing game-changing products that help our customers improve their productivity and succeed.”

Among the nomination entries comprising the best products, services and businesses in innovation for the year 2020, the HARVI™ I TE was chosen as a winner by a panel of over 3,000 leading business executives from around the world. “After a thorough review, the Edison Awards Judges recognise the HARVI™ I TE as a game-changing innovation standing out among the best new products and services launched in their category,” added Frank Bonafilia, Executive Director of the Edison Awards.

www.edisonawards.com
www.kennametal.com
Fraunhofer ILT’s ADIR project develops recycling concept for raw materials

The Fraunhofer Institute for Laser Technology (ILT), based in Aachen, Germany, reports that the four-year EU research project ADIR – ‘Next generation urban mining – Automated disassembly, separation and recovery of valuable materials from electronic equipment’ – which set out to develop a completely new, automated method of recycling electronic devices by disassembling them and recovering the valuable raw materials they contain, has concluded.

Led by Fraunhofer ILT, and involving eight project partners from three countries, the ADIR project’s strategic goal was to reduce the EU’s dependency on natural resources, reduce the need for costly imports of raw materials, and demonstrate new technologies for ‘inverse production’.

The new recycling concept focuses in particular on the elements tantalum, neodymium, tungsten, cobalt and gallium. Found in virtually every modern electronic device, these metals are valuable due to their scarcity, their cost – which in some cases is close to €250 per kilogram – and the tremendous difficulty of recovering them from used electronic devices in a cost-effective way.

The ADIR project consortium demonstrated the efficiency of its new recycling concept by disassembling around 1,000 mobile phones and over 800 circuit boards from computers. The results were presented at the Berlin Recycling and Raw Materials Conference from March 2–3, 2020, and at the Mineral Recycling Forum on March 10, 2020 in Aachen.

Fraunhofer ILT explains that ‘urban mining’, which refers to the recovery of secondary raw materials from buildings, infrastructure or products, is an increasingly important trend, which inspired Prof Reinhard Noll and Dr Cord Fricke-Begemann from Fraunhofer ILT to take a new approach to recycling. Together with the ADIR project partners, they developed a concept for the piece-by-piece processing of circuit boards from computers and obsolete mobile phones. Support for the robotics R&D required for the project came from the Fraunhofer Institute for Factory Operation and Automation (IFF) in Magdeburg, Germany.

The ADIR project revolves around automated, flexible processes designed to disassemble electronic devices to selectively extract valuable component parts at the end of their useful life. The disassembly plant relies on an intelligent combination of laser technology, robotics, vision systems and information technology.
Lasers play one of the key roles, performing tasks such as identifying what each component consists of and desoldering or cutting components out of the board in a fast, non-contact process. The patented procedure is believed to be an efficient means of recovering strategically important materials of high economic value on an industrial scale.

The project team reports that it has already received very positive feedback from experts at numerous events, especially among attendees of the Berlin Recycling and Raw Materials Conference and the Mineral Recycling Forum. “We’ve seen a great deal of interest from experts,” stated Dr Fricke-Begemann, Project Manager. “And this enthusiastic response has also inspired our industry partners.” These include the company Electrocycling GmbH based in Goslar, Germany, which has been trialling the ADIR method in field tests since late 2018 and validating it for industrial use.

In a series of field campaigns, the company used the ADIR demonstrator – consisting of seven inter-linked machines – to show how the developed processes can be used to extract significant quantities of tiny capacitors from electronic devices in order to recover tantalum. This task was carried out by the company H.C. Starck Tantalum & Niobium GmbH, which was also participating in the ADIR project.

“We disassembled around 1,000 mobile phones and over 800 large computer printed circuit boards, from which we recovered several kilograms of components for recovery,” added Dr Fricke-Begemann. “We were able to gain between 96 and 98% of the tantalum.”

The pre-competitive research project has now been completed, and the ADIR team’s demonstrator has confirmed the concept’s economic viability. “The knowledge we have gained so far has already enabled us to get part of the process chain up and running,” commented Professor Noll. “This includes inspection of the printed circuit boards as well as desoldering and removal of the components.”

www.adir.eu
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20th Plansee Seminar postponed until 2022

Plansee Group, headquartered in Reutte, Austria, has postponed its 20th Plansee Seminar, the International Conference on Refractory Metals and Hard Materials, until 2022 due to the disruption caused by the coronavirus (COVID-19). The seminar was originally scheduled to take place at the group’s Reutte headquarters from June 7–11, 2021.

In a statement, Karlheinz Wex, Chairman of the Plansee Seminar, wrote, “We, the Chairman of the Plansee Seminar and the whole Scientific Committee, have now decided to postpone the 20th Plansee Seminar by one year to 2022.”

“We hope that by then we will be able to hold the conference, which is characterised by a high level of free and direct social exchange and communication, as you have been accustomed to. We believe that you comprehend our decision and we hope to heartedly welcome you to the 20th Plansee Seminar in Reutte in 2022.”

www.plansee-seminar.com

ZF completes acquisition of WABCO

Germany’s ZF Friedrichshafen AG has completed its acquisition of commercial vehicle technology supplier WABCO, having gained approval from all required regulatory authorities.

“The combination of these two successful enterprises will bring a new dimension of innovation and capability for commercial vehicle systems technology,” stated Wolf-Henning Scheider, CEO of ZF Friedrichshafen AG. “Thanks to our perfectly complementary portfolios and competencies, we are able to offer unprecedented solutions and services for manufacturers and fleets globally. In this way, we are actively shaping the future of the changing transportation industry.”

According to ZF, in the future, WABCO will operate as an independent division, Commercial Vehicle Control Systems, within ZF and become the tenth division of the company. The new Commercial Vehicle Control Systems division employs approximately 12,000 people at forty-five locations globally and is expected to work closely with ZF’s existing Commercial Vehicle Technology division, ZF’s Aftermarket division and its global development team.

Jacques Esculier, Chairman and CEO of WABCO, has retired from his role and is succeeded by Fredrik Stae-dtler, who is said to bring commercial vehicle experience and was previously the head of ZF’s Commercial Vehicle Technology division.

www.zf.com
www.wabco-auto.com
EPMA launches R&D project on sustainability of press & sinter PM

The European Powder Metallurgy Association (EPMA), along with consulting companies PM Solutions and PM Consulting, have announced a new R&D project, the Life Cycle Assessment for Low Alloy PM Steel (LCA-LAPS) Club Project, which will quantify the environmental sustainability of press & sinter PM.

The objective of the twelve-month project will be to quantify the life cycle analysis for a high-volume press & sinter material (low-alloy steel from water atomised powders) in order to make a direct comparison to competing technologies possible, with parts subdivided into three weight classes (small, medium and large). The project will also produce individual company and site reports for the powder and parts producers participating.

According to the EPMA, the main consumers of Powder Metallurgy parts, such as the automotive industry, are meeting sustainability pressures towards carbon-neutral production and the new EU Green Deal, and many have plans to reduce their carbon footprint and the carbon footprint of the vehicles they manufacture.

This implies that their suppliers in the PM industry will also have to reduce their carbon footprint, and that suppliers will in future be selected based on their sustainability in addition to the quality and price of their products. Suppliers will have to give quantitative support to their sustainability claims, in competition with other technologies.

Powder Metallurgy generally claims to be a ‘greener’ technology, especially because of the very efficient raw material utilisation of net and near-net shape processing. However, the EPMA explains, some processes like powder atomisation and part sintering are energy intensive, and this may affect quantitative analysis of sustainability.

A study like the LCA-LAPS project, although it will be refined and updated over the coming years, may serve as a useful starting point to assess Powder Metallurgy’s environmental performance, and to help the participating companies to understand their position among Powder Metallurgy competitors.

Participants will have the chance to receive a site-by-site analysis of their production sites, and will then be able to compare the results for their sites internally and towards the averages taken over the whole consortium.

www.epma.com

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Seco/Warwick celebrates its 10th anniversary in China

Seco/Warwick, headquartered in Swiebodzin, Poland, is celebrating the ten-year anniversary of its operations in China. Since those local operations began a decade ago, the company states that it now has twenty times the sales revenue and more than sixty employees, 10% of which were present at the beginning of operations.

The company noted that over its ten years of operation in China, hundreds of solutions have been deployed; a 5,000 m² head office and manufacturing plant have been launched; patents have been achieved at the rate of at least one per year; the company has achieved National High-Tech Enterprise Certification as well as National Science; and it has gained clients across demanding industries such as aerospace, automotive, energy, tools and dies, etc.

Stawomir Woźniak, CEO of Seco/Warwick Group, was responsible for the formation the group’s branch in China, focusing his energy on establishing production, sales and service based on local engineering and technical resources.

There were reportedly two breakthroughs during the first year of operations in the Chinese market, connected to two major technologies. These technologies included CAB, in which Seco/Warwick states that it has become an unquestionable leader, and VAC, with a wide range of hi-tech applications for the aerospace, automotive and energy industries.

The first CAB line established at the Tianjin plant was installed and put into operation in September 2010. The system contained a dry-off oven and brazing system, and in the same year, Seco/Warwick started to build the first vacuum furnace, which was completed in May 2011. Two years later the first CAB system produced in China was exported to India, and is still in operation today.

The group explains that the first aluminium process project for a solution heat treatment and ageing furnace for the aviation industry was completed in 2014. In Vacuum Metallurgy, in 2013, Seco/Warwick Retech delivered a Plasma Welder for a titanium manufacturer which it states was a breakthrough project for the Vacuum Metallurgy product line.

Its Chinese operations reportedly gained new momentum in 2015 when Liu Yedong became its General Manager, implementing a number of actions to strengthen the company’s presence in the local market.

Seco/Warwick reports that the development of its technologies is the result of ongoing efforts by all its engineering and technical staff, working with clients on various markets across different industries, to understand common and new problems that lead to developing solutions. The Chinese team is believed to have provided many insights and solutions which resulted in twelve unique patents in heat treatment processing.

“We started in 2010, in the Chinese Year of the Tiger,” stated Stawomir Woźniak, CEO of Seco/Warwick Group and former Managing Director of Seco/Warwick China. “The Tiger, considered to be brave, cruel, forceful and terrifying, is the symbol of power. Founded in a tiger year, we were forging ahead, and we were brave enough to challenge and strive for a larger market share.”

Liu Yedong, current Managing Director of Seco/Warwick China, commented, “We went through different years representing various animals, learning their skills, their ways of thinking and acting. Today Seco/Warwick is in a different place since the start, and we’re proud of the whole team and their achievements, and looking to the future with the belief that we are on a good track to our Seco/Revolution.”

Höganäs publishes Sustainability Report 2019

Sweden’s Höganäs AB has published its Sustainability Report 2019 which includes its sustainability performance for the full year of 2019, and its revised sustainability strategy, the Climate Roadmap and its product vision. The report addresses each of Höganäs’ strategic focus areas, which include workplace, society, climate, environment, and products.

Fredrik Emilson, President and CEO, Höganäs Group, stated, “Our work to improve our sustainability performance continued during 2019 and our updated sustainability strategy will help us even further to set concrete targets that will move us in the right direction. Our present performance is commented on in each chapter of this report.”

He added, “We acknowledge the fact that sustainability is a complex field with many challenges. We are committed to taking our responsibility to drive the industry forward and in this report, we aim to give a transparent and honest description of our performance and challenges ahead.”

Höganäs summarised the following key figures which it achieved in 2019:

- 50% of Höganäs’ raw materials consist of secondary, or recycled material. Secondary materials include both pre- and post-consumer scrap
- 50% of its purchased electricity was from renewable or partly renewable sources
- 80% of all process residuals are reused with Höganäs’ target being 85%

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MTC reports successful conclusion of CASCADE

The UK’s Manufacturing Technology Centre (MTC) has reported the successful conclusion of the CASCADE project, which began in 2015, aimed at bringing together world-class expertise in powder atomisation, metallurgy, net shape part production and Additive Manufacturing.

Led by Liberty Speciality Steels (LSS) in Sheffield, UK, the project participants also included research and academic partners from the MTC, industrial partners Johnson Matthey, Renishaw plc, Atomising Systems Ltd (ASL), Hybrid Manufacturing Technologies (HMT) and Farleygreene, as well as research and academic partners at the Advanced Manufacturing Research Centre (AMRC), the University of Birmingham and the Warwick Manufacturing Group (WMG), the University of Warwick via a subcontract.

The need for a UK-based metal powder supply chain

As metal powders are primarily produced in Sweden and the USA, it was stated that a UK-based supply chain is needed to service a growing local market. LSS, as an experienced manufacturer of highly engineered steels, decided to tackle this need by expanding its capabilities into steel and nickel powder production, and sought the MTC’s support to achieve this.

Through the CASCADE programme, LSS and the MTC worked with the seven other partners to develop a range of technologies across the metal powder supply chain. Supported by Finance Birmingham via the UK Government’s Advanced Manufacturing Supply Chain Initiative fund, CASCADE enabled LSS to establish its first powder production facility.

The MTC supported LSS in developing powders by providing access to its capabilities, including its powder characterisation labs, industrial-scale Hot Isostatic Pressing (HIP) and Metal Injection Moulding (MIM) facilities.

Project completion

Successful completion of the project has enabled LSS to acquire a vacuum induction melting gas atomiser with an anti-satellite system from Atomising Systems Ltd. The atomiser is capable of producing highly spherical steel and nickel powders with a minimal amount of satellites and improved flowability, making them ideal for AM.

LSS has now established a new business, Liberty Powder Metals (LPM), as a UK-based powder metal supplier and innovation incubator supported by the Tees Valley Combined Authority. Up to fifty jobs are expected to be created as a result of the project. LPM has also developed the capability to handle and package powders under inert atmosphere to reduce moisture and improve powder performance.

www.the-mtc.org
www.libertyhousegroup.com
Prof Herbert Danninger to receive 2020 Ivor Jenkins Medal

The UK’s Institute of Materials, Minerals and Mining (IOM³) has named Prof Herbert Danninger as the recipient of its 2020 Ivor Jenkins Medal.

As Professor for Chemical Technology of Inorganic Materials at Technische Universität Wien (TU Vienna), Austria, Prof Danninger has been Dean of the Faculty of Technical Chemistry for eight years. He holds lectures about Chemical Technology, Powder Metallurgy, and Materials Science and Technology. In an academic career spanning over forty years, he has around 520 scientific articles published in peer-reviewed journals, as well as in proceedings of international conferences, predominantly on Powder Metallurgy.

“I feel very honoured to be awarded the Ivor Jenkins Medal,” Prof Danninger told PM Review. “I had the pleasure to meet Ivor Jenkins personally on numerous occasions, in particular the ‘Powder Metallurgy Group Meetings’ held in the 1980s every October.”

Graduating as an engineer (Dipl.-Ing.) from TU Vienna in 1979, he went on to complete his doctoral thesis (Dr. techn.) at the Institute for Chemical Technology of Inorganic Materials in 1980. He was later made head of the Powder Metallurgy Laboratory at the Institute in 1993 and became Associate Professor (Ao.Univ.Prof.) in 1997.

In 2002 he was named head of the Chemical Technologies Division at Institute of Chemical Technologies and Analytics and a year later was appointed to Full Professor for Chemical Technology of Inorganic Materials. Danninger became Director of the Institute of Chemical Technologies and Analytics in 2004 and became Dean of the Faculty of Technical Chemistry in 2011.

In addition to the Ivor Jenkins Medal, Prof Danninger has received numerous international awards in recognition of his work. These have included the Skaupy Lecture Award of the Gemeinschaftsausschuss Pulvermetallurgie, Germany, in 2006, the APMI Fellow Award from APMI International, Princeton NJ, USA, in 2010 and was named a Fellow of the EPMA in 2018.

www.iom3.org
Höganäs meets its 2010 target to reduce energy consumption by 10%

Sweden’s Höganäs AB reports that its Swedish production facility has reached its target to reduce its energy consumption by 10%, a target it made back in 2010 and realised in 2019.

Höganäs told PM Review that it is striving to be the natural choice for customers who desire resource efficient products with low climate impact. In 2011, the Höganäs Board of Directors set an energy efficiency goal to reduce its energy consumption with 10% per produced tonne of metal powder by the end of 2020. The group confirms that it reached this goal in 2019, but has also reduced its energy consumption even more over the years.

The group explained that, if it compares its current achievement with 2005, it has reduced energy consumption by 23%. Höganäs told PM Review that it achieved its target by introducing a certified energy management system in 2005. Thanks to this system the group has introduced structured ways of working with continuous energy conservation within production. An additional success factor is that the group’s goal was set at the highest management level, the Board, and made many investments where Höganäs saw potential energy savings.

According to Höganäs, these continuous energy savings together with efficient use of raw materials and climate neutral electricity are some of the steps the group is taking to reach its new objective which is to become a climate neutral operation by 2045.

Magnus Pettersson, Energy Coordinator at Höganäs, commented, “Lots of improvements have been made over the years by many involved, both better equipment and better working methods. The target also applies to the whole of 2020 and I hope that we will succeed this year as well.”

www.hoganas.com
Burgess-Norton to supply powertrain parts to Tenneco

Burgess-Norton Manufacturing Company, a business unit of Amsted Industries, headquartered in Geneva, Illinois, USA, reports that it has entered into an agreement with Tenneco Inc., a world leader in gasoline and diesel engine piston technologies, based in Lake Forest, Illinois, USA, to provide its full range of piston pin technology and bearing surface finish solutions for the Tenneco Powertrain Business Group.

Burgess-Norton is a global provider of precision bearing surface finishes, Powder Metallurgy technologies, and advanced manufacturing for automotive powertrain and mechanical power transfer markets. With global manufacturing capability across North America, Asia and Europe, the company provides regional customer support and simplified multi-source supply chain solutions.

“This agreement is a solid strategic fit for both companies,” stated Luke Rubino, President of Burgess Norton. “Tenneco is strategically focusing their powertrain technology solutions business for growth and superior pistons are a key component of that, and Burgess Norton is targeting opportunities to expand our capacity and our global precision power transfer technologies.”

Rubino added, “With this agreement, we’re combining more than 100 years of manufacturing and technical experience to strengthen our ability to efficiently deliver improved engineered powertrain solutions addressing fuel economy, power output, and lower emissions.”

www.burgessnorton.com
www.tenneco.com

Metapline opens new production site for highly spherical metal powders

Metalpine GmbH, Graz, Austria, a manufacturer of metal powder and part of the htm Group (high-tech metal investment GmbH), has opened a new production site based at its Graz headquarters, which will primarily produce highly spherical metal powders for use in Additive Manufacturing. An opening ceremony for the plant was attended by numerous representatives from politics, science and business including Dr. Karl-Heinz Dernoscheg, WKO Steiermark; Dr Robert Brugger, ICS Styria; Dr Gerald Sitte, Spacecone; and Klaus Fronius and Brigitte Strauß, Fronius.

According to the company, the total capacity of the new production site will gradually be increased to 400 tons per year, and using the in-house developed process, metal powders can reportedly be produced in a unique quality from a very wide range of metals and metal alloys (including copper, steel, nickel-based alloys, titanium, molybdenum, tungsten, etc).

Metalpine states that all its materials are produced using a flexible, environmentally friendly inert gas process under cleanroom conditions, and are aimed at highly demanding applications such as Laser Beam Powder Bed Fusion [LB-PBF], metal sintering, powder build-up welding or surface coatings.

Additionally, the new production site is believed to have a good network for industrial and academic research and development in the field of Additive Manufacturing, with research in the areas of production processes, materials and additives fields of application being carried out by the Montanuniversität Leoben and the Graz University of Technology.

www.metalpine.at
Formnext + PM South China has support from German manufacturing groups

Formnext + PM South China, scheduled to take place September 9-11, 2020, in Shenzhen, China, has announced official partnerships with the Aachen Center for Additive Manufacturing (ACAM) and the Verband Deutscher Maschinen-und Anlagenbau (VDMA), two of the most recognised advanced manufacturing groups in Germany. This strategic collaboration is expected to bring benefits to the Chinese market by showcasing some of the most recent technologies and products in Additive Manufacturing, Powder Metallurgy and advanced ceramics from Germany.

The Formnext + PM South China event is targeted at the Additive Manufacturing, Powder Metallurgy and advanced ceramics sectors and will take place at the Shenzhen World Exhibition and Convention Center. Located in one of the key cities of the Greater Bay Area of China, the show will put a strong focus on the Chinese market and cover an array of AM solutions and materials, smart manufacturing technologies and equipment, PM products, ceramic materials and forming technologies, post-processing solutions and more.

Formnext + PM South China’s mission is to shorten the manufacturing cycle time with lower cost and higher quality by integrating advanced materials, equipment and technical solutions into the manufacturing process, the organisers are bringing this to the fore through the cooperation with ACAM and the VDMA. ACAM will co-organise the Discover 3D Printing Seminar during the fair and showcase the latest Additive Manufacturing technologies and applications in Germany. VDMA will group its members in a pavilion to expand their overseas market, and to boost development for enterprises in the Chinese manufacturing industry.

Dr-Ing Kristian Arntz, Managing Director and Partner of ACAM, and Dr Markus Heering, Managing Director of the Additive Manufacturing Working Group of VDMA, also expressed their excitement about the new fair. “ACAM are excited about Formnext + PM South China, and will offer our services covering further education for companies as well as consulting and developments in the relevant areas of Additive Manufacturing to Chinese and other Asian manufacturing industries. We expect it to be a great show as the market is emerging and Additive Manufacturing is becoming more and more important to many companies in this area,” he stated.

www.formnext-pm.com

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New technology to separate rare earth metals reduces environmental impact

Nien-Hwa Linda Wang, the Maxine Spencer Nichols Professor of Chemical Engineering at Purdue University, West Lafayette, Indiana, USA, and colleagues have developed and patented a technology that has been successfully shown to separate rare earth metals without the environmental effects of conventional acid-based methods, reports AZoM. The technology, which offers high yield and purity, was discussed in an article published in the Royal Society of Chemistry publication Green Chemistry.

“About 60% of rare earth metals are used in magnets that are needed in almost everyone’s daily lives,” explained Wang. “These metals are used in electronics, airplanes, hybrid cars and even windmills. We currently have one dominant foreign source for these metals and if the supply were to be limited for any reason, it would be devastating to people’s lives. It’s not that the resource isn’t available in the USA, but that we need a better, cleaner way to process these rare earth metals.”

According to Wang, after China reduced the export quotas for rare earth metals in 2010, the costs of rare earth magnets for one wind turbine increased from $80,000 to $500,000. After China relaxed the export restrictions eighteen months later, the prices returned to lower levels than in 2010.

Wang continued, “Conventional methods for producing high-purity rare earth elements employ two-phase liquid–liquid extraction methods, which require thousands of mixer-settler units in series or in parallel and generate large amounts of toxic waste. We use a two-zone ligand-assisted displacement chromatography system with a new zone-splitting method that is producing high-purity (>99%) metals with high yields (>99%).”

Wang’s ligand assisted method reportedly has the potential for efficient and environmentally friendly purification of the rare earth metals from all sources of recylcates, such as waste magnets and ore-based sources and helps transform rare earth processing to a circular, sustainable process.

Wang added, “We continue to work diligently in the lab to learn how to adapt the ligand-assisted system to many variations we see in source material and are excited to collaborate with and assess the suitability of potential partners source material be it recycled magnets and batteries, coal ash or domestically mined ore.”

Joe Pekny, a Professor of Chemical Engineering at Purdue University explained that Wang’s innovation enables the USA to reenter the rare earth metals market in a significant way and sustainable way.

“Linda’s method replaces a very inefficient process and replaces it with an earth-friendly, safe extraction process, Pekny stated.

www.engineering.purdue.edu

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NanoAL’s Addalloy aluminium powder wins gold 2020 Edison Award

NanoAL, LLC, Boston, Massachusetts, USA, recently won a Gold Edison Award for 3-D Printing Enhancements for its proprietary Addalloy® aluminium powders. NanoAL is a subsidiary of Braidy Industries and serves as its research and development division, developing new aluminium alloys; the Addalloy family of high-strength aluminium alloy powders is specifically designed and developed for metal Additive Manufacturing.

The Edison Awards have been recognising and honouring the best in innovation and innovators worldwide since 1987. Addalloy Aluminium Powder was chosen as the 2020 Gold Award winner by an international panel of over 3,000 leading business executives.

“This award confirms the industry-wide need for NanoAL’s customer-centric approach when designing alloys for Additive Manufacturing. We fully utilise the process advantages of Additive Manufacturing without forgetting that customers need solutions that are cost-effective and easy to implement,” stated Dr Nhon Vo, NanoAL CEO.

The composition of alloys within the Addalloy family takes advantage of the atomisation and Laser Beam Powder Bed Fusion (LB-PBF) processes to create advanced microstructures with non-traditional strengthening mechanisms said to greatly enhance the performance of metal AM components.

Because Addalloy alloys, unlike some other next-generation aluminium powders on the market, are designed without expensive rare earth elements or complicated powder blends, they are reported to be both cost-effective and easy to use.

NanoAL is currently in the process of commercialising the Addalloy family of alloys. The current product line includes Addalloy 5T for structural components, Addalloy 75 for ultra-strong lightweighting applications, and Addalloy HX for thermal management.

Frank Bonafilia, Executive Director of the Edison Awards, commented on the Gold Award, “After a thorough review, the Edison Awards Judges recognise NanoAL Addalloy Powder as a game-changing innovation standing out among the best new products and services launched in their category.”

www.nanoal.com
www.edisonawards.com

Gasbarre thermal processing systems manufacture a range of steam treating furnaces, as well as PM sintering and other furnaces (Courtesy Gasbarre)

Gasbarre to ship multiple batch steam treating orders

Gasbarre Thermal Processing Systems, based in St. Marys, Pennsylvania, USA, part of Gasbarre Products Inc., has received three separate orders for batch steam treating equipment. Steam treating processes are used in many different industries and these orders will be shipped to companies that provide products to the medical, Additive Manufacturing, automotive and consumer products sectors.

The batch steam treaters produce an oxide layer that promotes corrosion and wear resistance properties and provides an attractive surface finish. The performance and quality of the surface and subsurface layers depends to a great extent on surface cleanliness and the overall (atmosphere) integrity of the equipment.

The three orders range in size from 45 cm to 76 cm diameter and 30 cm to 121 cm deep. The gross load weight capacity ranges from 136 kg to 816 kg with Gasbarre supplying the production tooling. The equipment is electrically heated and has a maximum operating temperature rating of 760°C.

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My first direct involvement with Powder Metallurgy was in 1998. I was previously employed in the outdoor power equipment industry as an Environmental, Health and Safety (EHS) manager and looked forward to applying my experience in a new arena. I found the powder metal processes fascinating. Compaction, sintering and sizing were new concepts, but they used presses and furnaces and mills and lathes. I had solid EHS experience in presses and machining, so this should be pretty much the same. As I soon learned: not so much.

Environmentally, Powder Metallurgy is a really good story. Sintered metal parts are made from a high content of recycled material. Sintered part manufacturing generally uses much less energy compared to machined metal from castings, billet or formed shapes. All said, the environmental footprint is really positive. A unique technology that helps benefit the environment. Looking good!

However, along with its unique benefits, Powder Metallurgy presents some unique risks and hazards. I have classified the safety risks into three basic groups – intervention, ergonomic and chemistry. In all cases, there are both behavioural and systemic aspects. I will also address some unique environmental risks we must be aware of.
Safety

In the United States, the average rate of recordable injury for general private industry is 2.8 cases per 100 employees. The PM industry’s safety performance, listed in NAICS classification 332117, shows a case rate of 4.5 cases per 100 employees, slightly above the 4.1 rate for fabricated metals in the 332 NAICS group [1]. That places PM at a rate of recordable injury 30% higher than general private industry. While there are some great things going on at individual sites, with multiple years of achieving zero lost time cases, the overall statistical picture indicates PM is injuring more employees than other types of manufacturing. If your site is operating at a level below the average, congratulations. However, I urge you to read on as it is quite possible that you are measuring luck as opposed to safety.

**Intervention risks**

As with all manufacturing, PM has fared well in the guarding of equipment for normal operations. Government regulations, supported by ANSI, DIN and other similar programmes, have gone a long way to upgrade machinery and press safety requiring duplicity of safeties, supervised circuitry and devices. Machine and press operators are protected by operator presence controls such as dual palm buttons, light curtains and interlocked guarding and doors. The overall effect of this is that machine and press operators have enjoyed improved safety performance, at least as long as they follow the rules and use the guards and

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**Fig. 2** It is important to understand the behavioural and systemic aspects of work safety in a PM facility

**Fig. 3** The various risk zones in operation depend on the setup procedures of the PM facility
EHS in the Powder Metallurgy industry

safety devices properly. In cases where equipment is not functioning properly or quickly enough, safety bypasses or shortcuts remove that layer of protection and injuries occur, often severe.

Setup and maintenance employees are especially at risk, and unfortunately this is the group more frequently subjected to injury. By design, setup operations and maintenance need to go beyond the safety barriers and devices in place to access the areas where the highest hazard exists. Further protection and safe performance of those exposed to these intervention risks relies on their training and completion of added procedures designed to replace the inactivated safety controls and guards. These additional procedures include proper Lock Out Tag Out (LOTO); de-energising electrical, pressure and gravity sources; and blocking equipment.

Unfortunately, there are a number of issues that erode good safety practice in setup and maintenance functions that are unique to PM. In the 1980s, the American National Standards Institute (ANSI) recognised that compaction presses were a different animal and developed a standard which exempted certain safeties in setup and maintenance, predicated on the multi-platen design and the difficulty blocking floating platens. This was also supported by the LOTO exemption for adjustment activities on presses. These exceptions, fuelled by tribal knowledge, the specialised nature of the setups and equipment, the need to save valuable time in setup and repair, all built a culture unique to many PM operations. I’ve often witnessed presses left powered on with controls set on manual while performing setup, because it was too much work to power down and then back up to test alignments. This is supported by a culture of “we’ve always done it this way”; “you don’t understand, these setups are different” and “it would double my setup time to keep powering off and blocking.”

Taking the shortcut then becomes the norm (Fig. 4). Sadly, this culture is measuring luck and calling it safety. Equally sad is that the majority of these incidents that I have investigated in my career resulted in severe injury and amputations.

“So – are you safe or lucky? Take the time to quietly observe a setup or maintenance intervention activity at your plant...”
or maintenance intervention activity at your plant. Did the equipment get locked out? Were energy sources eliminated? Were blocks being used? If used, were they used on the upper ram, the top punch, each platen that needed hand access? Are there solid setup LOTO procedures at the site of the machine? Are they used? If any of these issues exist, you are likely measuring luck. If your culture is not following LOTO religiously during intervention, you have some work to do to change it. Culture change is not easy or quick. Until you fix it, be sure to have well-trained emergency medical team members and strong knowledge of emergency procedures.

Ergonomic risks
Although musculoskeletal injuries aren’t particularly more prevalent in the PM industry, there are some risks that do relate to the powder process. First off is the weight of the powder. Ferrous powder is heavy. A two gallon bucket of compaction run-off weighs about 212 lbs. A good general estimation is 100 lbs per gallon. I have always been puzzled by the size of the run-off or waste powder container in relation to the acceptable ergonomic lifting guides recommending bending lifts closer to 50–60 lb. Back strains are still prevalent, and all are preventable.

The addition of robotic material handling has been a huge success in the reduction of ergonomic injuries in the PM industry and once again, we have seen a drop in operator strain injuries (Fig. 5). Many facilities now recognise good ergonomics, have addressed frequent, repetitive parts handling, and have introduced limits on bending, reaching and twisting. Good posture, work-station design and mechanical assist have all worked to reduce these injuries.

Once again, non-standard work and intervention activities still have a bearing in this area, and culture is a part of the problem. The ‘muscle man’ style of thinking, and the pride of being able to lift heavy objects, lead to less requests for assistance and, more often than not, cumulative strain and sprain injuries. Setup and maintenance are at an additional risk due to the weight of tooling and dies, machinery components and confined access to components, which limits the accessibility for operating lifting devices.

The preventive actions needed are solid work procedures, visual standards, training, competence and supervisory enforcement. You need to limit the exposures and change the culture.

So, are you safe or lucky? Quiet observation [management by walking about - management by observation] is a great tool to get your answer.

Chemistry risks
One of the reasons Powder Metallurgy is so environmentally friendly is that it is limited in wet processes. Liquids on site are generally limited to non-contact cooling water, hydraulic oils, rust proofing solutions, machinery coolants and limited exposure to battery acid. I will speak to these a bit later from an environmental perspective, but the current discussion will focus on safety risks.

The use of combustible oils, rust proofing and solvents isn’t particular to PM and is generally well managed through minimised direct contact, good ventilation, good Personal Protective Equipment (safety glasses, gloves, face shields, etc), secondary containment and spill control.

Coolants and rust proofing are usually dehydrating to skin, can cause acute and chronic rashes, and are often an inhalation irritant.

The use of cryogenic liquids (CO₂, Nitrogen, etc) is well-controlled and exposures to cryogenic temperatures are infrequent, although not to be discounted. Solid work procedures, visual standards, training, competence and supervisory enforcement are necessary to proactively manage the hazards.

Sintering atmospheres present added hazards that are more common to PM. The hydrogen gas used in sintering furnaces is highly flammable and is odourless, making it difficult to detect leaks. Hydrogen will quickly rise to the upper levels of a facility and dissipate to the

Fig. 5 The addition of robotic material handling has been a huge success in the reduction of ergonomic injuries in the PM industry
outside via roof vents and even small openings. A hydrogen leak can often go undetected for long periods of time. Once they are large enough and confined in a space, the situation can become serious in an instant. Hydrogen fires and explosions are often the catastrophic results of a chronic, long-term failure.

Endothermic gas (commonly called endo) is created by cracking natural gas. It is also highly flammable, odourless and difficult to detect. Unlike hydrogen, endo has a density closer to that of air and, without good ventilation, it will mix closer to the floor. The primary constituent of endo is carbon monoxide, an inhalation hazard that can cause serious injury, including fatality, dependent on the volume and duration of exposure.

Not as common today is the use of anhydrous ammonia to generate a hydrogen/nitrogen ($\text{H}_2\text{N}_2$) atmosphere. This was more common twenty years ago. Anhydrous ammonia, prior to being cracked (or dissociated) into $\text{H}_2\text{N}_2$, is a cryogenic liquid that can freeze skin, severely dehydrate tissue and is a poisonous gas with very low thresholds. The strong odour makes it easy to detect at low levels, and it is difficult to stay in the vicinity of an ammonia leak unless trapped. The presence of anhydrous ammonia in an operation requires a Process Chemical and Risk Management Plan in coordination with local and regional emergency planning and response.

In all cases, the use of sintering atmospheres requires frequent inspection, leak testing, and in the case of carbon monoxide from endo, air monitoring is required to insure there is no exposure to employees. A strong industrial gas programme in coordination with your supplier and local fire departments is critical to a solid safety programme, in addition to solid work procedures, visual standards, training, competence and supervisory enforcement.

“A strong industrial gas programme in coordination with your supplier and local fire departments is critical to a solid safety programme…”

An important part of industrial gas safety is pipe labelling, flow and valve identification (Fig. 6) and the installation of properly operating furnace exit flame curtains. Flame curtains need to be functional and failures should be cause for immediate repairs. A flame curtain doesn’t

Fig. 6 Essential for industrial gas safety is pipe labelling, flow and valve identification
really appear to do much – it does help reduce emissions and prevent combustible gas going up the flue, but its critical function is when things go wrong. Changes in draft, blocked flues or strong crosswinds can cause atmosphere gases to escape into the workspace. A flame curtain assists in burning off the gas and reduces the chance of filling the room with atmosphere gases. NFPA 85 provides excellent standards for sintering furnaces.

One other common failure I see in PM operations is the failure to properly vent the diaphragm vent located on gas pressure regulators. Often, large regulators in use on gas and atmosphere trains are designed for external location and vent to the air. When installed inside the building on the furnace or endo generator, they vent to the room. During normal operation, this is no issue. During a failure of the diaphragm, the gas will directly vent through this port and can present a significant leak of hydrogen, endo or natural gas into the building and generate a catastrophic condition in terms of a fire, explosion and, in the case of endo, inhalation hazard.

The last chemistry risk I want to note is fairly unique to PM, although there is increased recognition in grinding and polishing operations in other automotive and aerospace industries. This hazard is the combustible property of metal dust. Dusts from aluminium, magnesium and titanium are combustible on contact with an ignition source, and this is further complicated by the violent release of hydrogen when doused with water, especially if the dust or powder is hot.

The difference between powder and dust has to do with particle size. The smaller the particle, the higher the hazard. In general, ferrous particles larger than 150 μm are difficult to ignite. Powders become more combustible the lower the particle size (Fig. 7). Nano-particle sized metal dusts can become pyrophoric and self-ignite.

Most ferrous dusts are not a hazard when in a state of zero energy – i.e. lying in an undisturbed pile, on a floor, on a surface, in a rafter, etc (Fig. 8). The hazard is when the powder/dust becomes airborne. Clouds of ferrous particles are combustible. In the right density and if confined to a closed space, they can become explosive. The explosion hazard is not common, but it does exist. It can occur. If the particle volume is high enough for the area in which it is dispensed, it can happen. This exposure is magnified by dusts that accumulate on high surfaces like beams and rafters. If disturbed, the dust can fall from the upper surfaces and create a cloud of falling particles that can ignite.

“The smaller the particle, the higher the hazard. In general, ferrous particles larger than 150 μm are difficult to ignite.”
In catastrophic cases where this has happened, the fire has been violent enough to cause a shock wave which disturbs more dusts, which then build to an explosible condition. For this reason, the NFPA 484 Standard for Combustible Metals requires cleaning of dust from elevated as well as lower surfaces. Clean is safe. Additionally, NFPA 484:2019 provides requirements for dust collection, vacuums, ignition control, static electric control, grounding, etc.

The most recent version has some changes and reciprocity requirements that may affect your current operations, especially in the proper labelling and automatic fire suppression areas. At a minimum, I would recommend you sample and test your dusts. This is the start for a Dust Hazard Analysis procedure, which you are required to have completed. If you haven’t yet addressed this, I strongly suggest you develop a plan with someone knowledgeable with the standard.

I also recommend you read a copy of the standard to better interpret your potential situation and be able to recognise the proper qualified source for help. There is still a lot of misinterpretation and myths out there. If your dust tests positive as combustible, you need a programme.

Again, are you safe, or are you lucky? Take a walk and see how clean your facility is. Look in the press pits, check the rafters. The higher your dust accumulation is, the higher your risk is. If you blend powders on site, your exposure is aggravated as the blending materials, like graphite and wax, are even more combustible and often highly ignitable by low levels of electrostatic energy.

Environment

Congratulations PM, you are a green business. You use recycled metals. Your carbon footprint is much lower than most manufacturing and steel production. You don’t use a lot of chemicals. For the most part your air permit is classified as a minor source. If required, emission control is fairly simple. But there are some things that are unique to PM that need control. As with the safety portion of this article, I will classify the environmental risks into some basic areas: recycling, spill control and storm water.

Recycling

A large percentage of PM facilities are automotive suppliers and thus required to be certified in ISO14001 Environmental Management. As part of this requirement, you have developed a policy that requires you maximise your recycling efforts and you likely track your waste disposal and recycled volume as a Key Performance Indicator (KPI). Take a hard look at your recycled metal volume (Fig. 9) and see if you can split it by source: how much is used powder, how much is off-spec sintered parts, how much is facilities and maintenance scrap metal and how much is dust collector material?

Let’s look at the powder and off-spec sintered metal numbers. As a general estimate – maybe you are buying the powder for $0.50 to $1.50 per pound. You can calculate your average. For the sake of a simple example, I’ll use $1.00/lb and assume that this includes the costs of shipping, warehousing, loading, unloading and otherwise handling. Multiply your monthly or annual volume recycled in pounds times $1, and that’s the approximate cost of the powder you bought that ended up as waste and recycled. On the average,
you can get $0.06 per pound from the metal recycler. So, recycling is costing you $0.94 per pound. A site with 10,000 lbs recycled metal per month is losing $112,800 per year. The $1 per pound generally works for the cost of the maintenance scrap as well. The more you recycle, the more you lose in profit. In the spirit of recycle, reduce, reuse, you will find it well worth the effort to take a hard look at where the waste material is coming from and why. Theoretically, all powder you buy should go into parts that you can sell.

Quality programmes look hard at reducing sintered part waste; be sure the numbers match the waste volume you see. Take a walk and identify where the powder waste is from. Spilled containers, inefficient transfer of powder to the die in presses, bad housekeeping. Look in your press pits, are they hiding spilled powder? It’s costing you $0.94 per pound. Remember that two-gallon bucket of run-off powder? It’s costing you about $200 in lost revenue. It does hide as being environmentally good indicator – 80% of waste is recycled and not landfilled. But you can’t stop there. I suspect that for many of you, 120,000 pounds per year is a low estimate.

Spill control
In line with ISO14001 and government regulation, you likely have a Spill Prevention Control and Countermeasure Plan (SPCC). It is also highly likely the plan does not address one of your major sources of oil loss, press pits. I rarely find a clean, well-maintained press pit. If yours are maintained as clean and dry – I commend you. More likely, they are stained concrete with indications of prior spills, or, even worse; designed with a floor grate in place so that maintenance employees and setup personnel can walk in the pit and stay dry.

I have been involved in a number of sinter facility closures, sales and construction/expansion projects through the years, and have not yet found a facility that didn’t have oil exposures in its press pits. This is troubling for two reasons. One is that hydraulic oil is not supposed to be a consumable. Take a look at your oil use volume and costs; I venture a very small piece of this is from oil changes. The large percentage of this volume is from leaks.

The second issue is environmental. Concrete is not an effective barrier, it’s more like a filter. Large amounts of oil will seep through the concrete over time (Fig. 10), and even with a floor coating, the oil will degrade the slab joints, transfer through cracks, etc. Every pit I have tested, or witnessed removed, showed soil contamination at various levels around the exterior of the pit wall. Often the contamination is contained within the footprint of the building and doesn’t present an environmental threat to the water table. However, I have also seen

![Fig. 10 The soil surrounding press pits can become contaminated with expensive hydraulic oil](image-url)
just as many cases where further contamination was found that went beyond the building and even the property. As you can imagine, the costs to remediate these issues were astronomical.

I realise that fixing leaking seals on a press can get pricey, dependent on what seal is leaking. Just the same, leaks should not be accepted as a standard result of PM processes. The equipment wasn’t designed to leak, and the pits were not meant to serve as a tank.

**Storm water**

Storm water management is not unique to PM, but there are some changes in state and federal storm water management that may affect you in the near future, if they haven’t already. Most PM sites limit their exterior activities and are exempted as non-exposure sites. That is a good thing, as sites requiring regulated storm water plans are finding that sampling and acceptable levels continue to drop and that it is becoming more difficult to comply.

Almost all sintering sites cool their furnaces with non-contact cooling water circulated through a cooling tower. The blowdown is usually a permitted activity, normally to sewer. Some localities have compromised combined storm and sewer networks and forbid non-contact cooling to the sewer.

Complicating this issue is an increased regard for the level of chlorine in the discharge to storm water. Often, this level is well below the level of chlorine found in your supplied city water. This is problematic. Most recycling towers have a need to go offline for maintenance or due to mechanical failure; at that time the systems switch over to straight city water. This means you are exceeding the chlorine limit to storm water.

Unfortunately, there is no good way to address intermittent high-volume discharge chlorine adjustment. The processes are challenging and the costs are high. I would suggest proactively taking some samples of your discharges in order to understand the system you have. Keep an eye on your local and state regulatory activity, as it’s likely going to affect you in the next two-to-three years.

**Summary**

PM is a unique business with environmentally sound processes and high-quality products. With great success come some opportunities for unique EHS issues as well. Be active in management by walking about and manage by observation. Quiet observation, when feasible, provides a scenario where the employee doesn’t feel they are being inspected, audited or critiqued, and is a good way to observe true behaviour.

Observe from a comfortable distance, then be sure to approach the employee, introduce yourself if needed, ask them to describe what they are doing, how and why. Also insure you note and communicate any issues you see where they are not following safe procedure. If you don’t, you will have inadvertently indicated that you accept the procedure and therefore promoted bad behaviour and fed the culture.

I hope that you have found this article informative, and that it offers a way to look at your processes and determine if you are safe, or maybe, just lucky.

**Author**

Paul Hoffmann, CEI/CES, has worked in EHS in manufacturing for over forty years with over twenty years in the PM industry on site, regional and global assignments. He is a Certified Environmental Specialist and Certified Environmental Inspector with the Environmental Assessment Association. He currently operates as an independent consultant providing assistance in ISO14001, ISO45001 and ISO50001 Management Systems as well as topics involving Combustible Metal Dust management.

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**References**

Do you belong to the world of additive manufacturing?

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Where ideas take shape.
In 2016, Höganäs AB carried out teardowns on a number of vehicles, and in 2017 published an article in Powder Metallurgy Review regarding some of its findings [1]. The most interesting of these teardowns for the US market was the Ford F150 pick-up truck (Fig. 1), with its then-new ten-speed automatic transmission. In 2015, hybridisation was nothing new, but no hybrid trucks were commercially available. Ford later announced that it was developing one, but has since been very secretive about the technical details. It is not yet clear what the total mass of PM parts in the vehicle might be.

During 2018, Höganäs and Dontyne worked together on a concept for hybridising a truck with a longitudinal driveline layout, with the goal to estimate the amount of PM parts that are possible in such designs. In 2019 Höganäs worked on a further project with Alvier Mechatronics and Dontyne looking at a Battery Electric Vehicle (BEV) drivetrain.

As reported in Powder Metallurgy Review in 2017, the market share of SUVs, trucks and other passenger cars was depicted as in Fig. 2. As can be seen in this graphic, pick-up trucks, which share a lot of driveline parts with SUVs, represented about...
Hybridisation of pick-up trucks

The market for hybrid vehicles in the USA

To help understand the future opportunities for the US PM industry, it is important to learn more about the impacts of hybridisation on the largest vehicle segment in the US, trucks and SUVs. So far, the Dodge Ram has been introduced to the market with a start stop generator/booster in a P0 hybrid configuration, and similar P0 technology was also used in a limited series production of Chevy Silverado in 2014.

The P0 type of hybridisation technology has little impact on PM, since it does not allow downsizing. If anything, P0 hybridisation will increase the chances of getting more PM into these vehicles, since it consists of an electric motor/generator and belt pulleys, which are potential PM parts, as well as inductors in the power electronics.

However, the F150 is expected to take hybridisation one step further and start with a single electrical motor in a P2 configuration, meaning the motor is placed in the bell housing of the transmission instead of at the front of the combustion engine as in a P0. This is just the start; Ford is considering a fully-electrified F150, according to a statement by Bill Ford [2].

In the P2 hybrid configuration, the future looks bright for PM, since a regular automatic transmission will most likely be used and that transmission hosts a number of good but challenging PM part-candidates. In addition, a P2 configuration alone does not allow for much, if any, downsizing of the engine, especially not in a heavy SUV or pick-up truck. Furthermore, the electric motor has a lot of space radially but not axially in the bell housing when the torque converter is replaced. This means three things:

1. A YASA (Yokeless And Segmented Armature) type motor would be a good fit geometrically, with a high power density and high torque with a limited axial build space.

Dodge has begun selling the Ram as a hybrid in P0 configuration, while the Chevy Silverado was hybridised in 2004 with a mild P2 configuration [Fig. 3], but only a limited number were made. Ford's hybrid F150 is reportedly coming in 2020, but very few details have yet been released about its hybrid architecture, and in fact no technical details are available online except that it will sport some form of battery power converter, since 115 volt power outlets have been requested by the campers and contractors that are currently strapping generators to the truck bed to get electrical power.

one third of the sales volume, and together with the SUVS made up two thirds of vehicle sales. These three pie segments represent the twenty best selling vehicles in the USA in 2015/2016, and are referenced in more detail in the original article [1]. Many of the SUVs and pick-up trucks found in the US automotive market share components and systems, and both segments are important to the PM industry. With hybridisation, some typical PM parts may not be present in the hybrid versions, depending on how hybridisation is achieved. With that in mind, an attempt to predict what is in store for the PM community was made.

Fig. 2 Market share between different vehicles in the USA [1]

Fig. 3 The Chevrolet Silverado 1500 Hybrid was introduced in 2004

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2. A lower RPM motor needs less gear volume to reduce RPM, thus keeping within a small build space.

3. A six-cylinder engine will be retained, with its current PM parts, since the P2 configuration likely will not allow for any meaningful downsizing without reducing performance. Potential buyers for hybrid SUVs and trucks are likely not interested in less performance compared to the non-hybrid version of the same vehicle.

The P2 configuration is a relatively simple PHEV configuration, with a standard P2 E-motor in parallel. A hybrid unit such as the Schaeffler 80 kW motor (Fig. 4), comprising an engine damper, a disconnect clutch and one-way clutch integrally mounted within the motor rotor, would fit into the bell housing of a typical existing truck transmission case, with some modification to the interior for mounting purposes and an aperture for control access.

Although in theory there is no need for a separate generator, relying on slack E-motor capacity to charge the battery, in practice consideration must be given to the vehicle’s dynamics and requirements. A vehicle of this type will spend a large percentage of total time drawing on the E-motor (heavy payload, gradient acceleration, high air-resistance, etc), and it is thus probable that there is insufficient capacity under light load and braking to generate sufficient charging capacity.

Another drawback of this arrangement is that a multi-speed transmission is required to generate useable torque at the wheels and the engine is used across the whole speed range, which reduces the fuel efficiency and weight reduction benefits compared to a more modern multi E-machine configuration, allowing for regeneration and torque fill to keep ICE working closer to its peak efficiency.

The automotive industry is well aware of all the pros and cons of this type of engine, but development is mostly sequential and a possible way forward could be a design utilising a power-split transmission that allows for two E-machines and better overall efficiency of the total system. At the end of the development tunnel, there might just be the electric or fuel-cell truck, and Tesla’s claim that it will soon put its Battery Electric Trucks (BET) on the market is of course fuel to the fire (Fig. 5).

In order to better understand how a pick-up truck can be hybridised and which parts might offer potential for Powder Metallurgy, Höganäs, Dontyne Gears and Alvier Mechatronics investigated a future truck hybrid concept and tried to quantify parts and weights while achieving a good PHEV architecture.
Hybridisation of pick-up trucks

"Four-wheel drive is achieved by keeping the transfer case. The general transfer case contains a high amount of PM parts already, such as sprockets and carrier..."

for this type of vehicle. For reference, a truck with 4WD capability generally contains 30–32 kg of PM parts. In total, a truck typically contains between seventy and seventy-five different PM applications, with PM part weight in the range of 5 g and 2.37 kg. In an automatic truck transmission, there is typically around 5–6 kg of PM parts, mostly as carriers and clutch plates. Around 5–6 kg can thus be considered as the minimum target weight that has to be filled by a hybrid solution for the PM industry not to lose volumes. If the engine is downsized, as in this study, there will also be less PM in the combustion engine.

One concept that was considered in the underlying work was the electric rear axle combined with a transversal P1 or P2 mounted drivetrain, making the truck essentially a Front Wheel Drive (FWD) truck. The argument against FWD trucks has been that they handle poorly, since all the weight is up front, and when heavily loaded there is less traction on the front wheels, deteriorating towing and hauling performance. The platform also has to work in the 2WD version and 4WD non-hybrid version for the production economics. The Honda Ridgeline, however, is an exception, having a transverse engine and gearbox, with sales of 30,000 in 2018. Ford alone sold 909,000 F series trucks. This is another reason why a concept with an RWD architecture was chosen.

Concepts

There are many technical solutions to hybridise a car or a truck, far too many to present here. The type of hybrid proposed in Fig. 6 is what is referred to as a Power Split Dedicated Hybrid Transmission or PS-DHT. Here, the layout of the proposed system consists of the ICE, two E-motors and a power-splitter i.e. a planetary gear system. The two E-motors are connected to the planetary sun gear (E-motor 1 through a chain or gears) and the ring gear (E-motor 2, direct drive); similar, but not identical, to the first generation Toyota Prius. There are a number of possible drive modes with this setup. The ICE is connected to the carrier, usually with some kind of damper or clutch, see Fig. 6.

1. As the vehicle accelerates normally from stationary, the engine is turned off and the only source of power is from E-motor 1. The brake is applied to lock the planetary carrier (or a one way clutch). With the carrier locked, E-motor 1 drives the sun gear and the output is through the ring gear.

2. As the vehicle achieves cruising speed, the internal combustion
engine (ICE) is turned on and the brake on the carrier is released, the sun gear break is applied and power switched off to E-motor 1 (the break can be omitted). At this point, the only power source is the internal combustion engine. With the sun gear fixed, the input is to the carrier and the output is through the ring gear. The ICE will now operate around its peak efficiency. E-motor 2 will engage according to an as-needed algorithm.

3. When rapid acceleration is required, the two primary power sources work in tandem. E-motor 1 is also powered and both brakes are deactivated. The sun and carrier are driven independently, and the ring gear is driven by E-motor 2 and delivers the output power.

4. Regenerative breaking is possible through either one or both motors.

There is a price to pay for the fuel economy gained by limiting the speed range of the internal combustion engine, in that the internal combustion engine does not produce maximum torque to the wheels. In addition, there will be efficiency losses in the gear train of roughly 1–3% in each helical gear contact, a few percent in the chain and 3–5% for the splitter. If the ICE, in order to optimise fuel consumption, is not allowed to operate at max torque, the E-motor 2 is added. E-motor 2 is connected directly to the output of the power splitter to fill in torque when needed, such as for towing or overtaking. By matching the speed of this E-motor to the output speed of the splitter, the torque generated by the E-motor is added directly to the system. This system allows for complete flexibility of engine speed, road speed and torque to the wheels. In addition, the combination of the three motors can produce more torque than the internal combustion engine and E-motor 1 combined, and...
also allows improved fuel economy
to be achieved by reducing the ICE
size. The six-cylinder engines are
outselling the V8 engines, and with
two E-motors the ICE could likely
be reduced to a four-cylinder turbo-
charged engine reducing mass and
volume in the engine compartment.

E-motor 2 is always connected
to the ring gear and the ICE, and
E-motor 1 does not actually need a
clutch/break but it is often included
as a damper, since synchronisation
of the three motors is not always
perfect. The number of clutches/
breaks increases complexity and cost
but could improve efficiency under
certain running conditions, so it is
a tradeoff. The use of one clutch/
damper between ICE and carrier is a
common design, but so is a one way
clutch between E-motor 1 and sun
gear, like in the Aisin HD-10

Another option would be to install
one or both motors coaxially, which
would add to the longitudinal build
space. This system would then be
very similar to some of Toyota’s
E-CVT models, or have one or two
motors connected by chains or
gears, which Toyota also did in its
Generation 1 Prius. Ford used two
parallel motors in its AISIN HD-10,
and later models of Prius have the
same configuration as the HD-10
and HD-20, where gears are used
between E-motor 2 and ring gear.

Allowing the ICE to work momen-
tarily at peak torque in conjunction
with the two E-motors is also an
option. This would produce a massive
amount of torque, but would require
the gears and shafts to be bigger
and heavier to support the increased
power.

The conclusion is that there are
several configurations to achieve
the desired hybridisation, and in this
article the focus is on the concept
suggested in Fig. 6. Depending on
which concept is chosen, the amount
of sintered parts will differ by a few
kilograms. The reason for choosing
one system over the other is mostly
related to packaging, but there are
claims of higher efficiency for the
parallel gear driven system [3].

Four-wheel drive is achieved
by keeping the transfer case. The
general transfer case contains a high
amount of PM parts already, such as
sprockets and carrier. The planetary
gear system inside the TC is normally
made in steel and the parts could be
an attractive conversion opportunity,
as shown in Fig. 7.

Electrical motors

E-motor 1 is specified as a 50 kW / 48
V combination of a radial (35 kW) and
axial (15 kW) flux motor/generator
connected to a fixed two-stage
transmission reducing speed by a
12:1 ratio and ramping up torque for
low- to medium-speed driving,
and will give an extra 250 Nm to
the wheels but only up to 60 mph,
and thereafter would only work
as a 35 kW radial flux motor up to
maximum speed of about 120 mph.

Fig. 8 depicts the motor and trans-
million of which can be found in [4].

E-motor 2 is a 35 kW radial flux
machine identical to the radial flux
machine in motor-generator 1. A
gear ratio of around 10:1 to the
ring gear will add 200 Nm of torque
to the wheels. Theoretically, this
will give a top speed of 120 mph,
though with losses it will be more
in the vicinity of 105 mph, which
is a normal top speed for a truck.

Add to this the ICE and there will
be sufficient torque available for
towing but battery capacity will
be limited for how long the torque
from the E-motors will be available.

It is a matter of preference on
how much the ICE can be down-
sized, since for this type of vehicle
users might want to tow trailers in
areas with inclinations, and as such
a downsized ICE, in combination
with limited battery capacity, will
become a bottle neck and hamper
uphill speed. The ICE engine
options typically vary from 255
to + 700 Nm of torque in a truck,
depending on which ICE is used. So,
given all these pre-requisites and
assumptions, how much room is
there for PM in this design?

Potential quantities of PM
in this system

In order to get a better under-
standing of the weights of the drive
system in Fig. 6, a 3D model was
built and weights were calculated
from the CAD software (Fig. 9).

Fig. 10 shows a demonstrator that
was built to illustrate the system.

In the current configuration,
using Hy-Vo chains and pulleys to
connect the E-motors, a total of
around 20 kg can be produced as
sintered structural parts or as SMC
stators and rotors for the E-motors.
The different parts and their weights are listed in Table 1. Realistically, not all parts listed below will be made by PM. For example, the large output gear weighing 4.2 kg would require a 1200 ton press, and not many are available with helical gear adapters. In addition, the carrier could be a hybrid, leaving out another 940 g. However, if the differential cage was to be made by PM, another 3–4 kg could be added, so the potential for PM in hybrid systems still lands on 15–25 kg depending on part size, architecture and the amount of PM parts that can be sourced, as well as the use of one or two E-motors.

The carrier is slightly over-designed, and can probably be optimised in terms of weight by thinning out the wall thickness. As a reference, the heaviest carrier in the F150 transmission weighs 1.8 kg. However, the sprockets for the chain are relatively lightweight in this design. The transfer case sprockets weigh 1.8 kg and 2.3 kg in the F150; this is not an exact number in any way, but it gives hint as to the possibilities. The total weight of the system is around 85 kg, excluding inverter, battery and differentials.

**Downsizing**

As mentioned earlier, this system would allow for downsizing of the ICE, since there is enough torque fill capacity in the two E-motors to make up for lost torque at low to medium speed. Downsizing a six-cylinder naturally aspirated SI engine to a four-cylinder turbo-charged SI engine means that, in the best case scenario, only two connecting rods will be lost. A large part of the connecting rods in the six-cylinder truck engines are powder forged. Each connecting rod weighs 400 g. The worst case is that 2.4 kg of connecting rods are lost. Also, a shorter crank shaft and cam shaft will need fewer bearing caps. A four-cylinder engine can be assumed to have one less bearing cap than a six-cylinder engine, and they will likely be slightly smaller. That will bring the PM content down another 1.2 kg. The cam shaft bearing caps are made in aluminium in many engines today, and in other modern designs the cam shafts are assembled inside the aluminium head without any bolt-on cam bearing caps, so any loss from cam caps is not brought into the equation here.

**Omitting the automatic transmission**

In the ten-speed automatic that was analysed in the teardowns in [1], 5.4 kg of sintered parts were found in the transmission in the

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*Fig. 10 Prototype of hybrid drive system on display*
form of carriers, oil pump, backing plates, etc. So the total offset from downsizing of the engine and removing the automatic transmission will be closer to 10 kg. Winning back those volumes by putting PM parts and systems in new hybrid drivetrains is very much achievable, and our industry will have to pursue the opportunities that are out there and work more closely with design houses and OEMs, as well as investing in technology that promotes productivity and allows for complex geometries to be compacted.

Modularity

The Connactive drive system from Alvier and Dontyne, comprising a dual drive E-motor and a two-stage gear reduction unit, is actually designed as a drivetrain for smaller urban BEVs, but can be repurposed to work in a hybrid electric vehicle drivetrain. And the axial flux and radial flux machine parts in this dual drive configuration can be separated and the parts used to build a pure axial flux or radial flux motor, which is also done in this hybrid drivetrain where E-motor 2 is identical to the axial flux machine in E-motor 1. This will allow greater production numbers for each tool and help mitigate the investment risk, as well as carrying the depreciation cost of tooling over more than one vehicle.

Conclusions

In this article, we have presented a hypothetical hybridisation of a truck with the ambition of gaining some understanding of the possible PM content in the next generation of hybrid trucks. Using a power-split transmission as the basis, and coupling that with two E-motors, gives a more efficient type of hybridisation compared to what is available today for trucks and P2 architectures. The amount of possible PM/SMC parts in such a transmission is in the order of 20 kg +/- 5 kg depending on how the E-motors engage, total power output and architecture. The distribution between PM structural parts and SMC parts is about 60/40, and the system weight is around 85 kg.

Downsizing the combustion engine from six to four cylinders will result in a loss of 3–4 kg of PM parts using a non-conservative estimate, while omitting an automatic gearbox will render a loss of around 5–6 kg of PM parts. But even downsizing of the combustion engine and omitting the automatic transmission will not offset the positive impact hybridisation will have on the total mass of PM parts that are available in these types of systems. The challenge is to demonstrate the feasibility and advantages of powder metal in hybrid transmissions before the designs are set and material is chosen.

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References


Table 1 Potential weight of Powder Metallurgy components in the concept hybrid drive system

<table>
<thead>
<tr>
<th>Potential PM components</th>
<th>Mass (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parts in the power-splitter</td>
<td></td>
</tr>
<tr>
<td>Ring gear (gear only, not backing plate)</td>
<td>3.0</td>
</tr>
<tr>
<td>Planetary gears x 3</td>
<td>1.5</td>
</tr>
<tr>
<td>Sun gear</td>
<td>0.9</td>
</tr>
<tr>
<td>Carrier spider wholes</td>
<td>2.5</td>
</tr>
<tr>
<td>Oil pump gear driver and driven</td>
<td>0.8</td>
</tr>
<tr>
<td>Carrier backing plate</td>
<td>0.9</td>
</tr>
<tr>
<td>Ring gear hub</td>
<td>1.3</td>
</tr>
<tr>
<td>Chain sprocket x 2</td>
<td>2.0</td>
</tr>
<tr>
<td>Reduction gear drive</td>
<td></td>
</tr>
<tr>
<td>Idler output to output gear</td>
<td>0.4</td>
</tr>
<tr>
<td>Output</td>
<td>4.2</td>
</tr>
<tr>
<td>Pinion</td>
<td>0.4</td>
</tr>
<tr>
<td>Idler gear</td>
<td>1.9</td>
</tr>
<tr>
<td>Parking gear</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Total excluding E-motor SMC</strong></td>
<td><strong>20.3</strong></td>
</tr>
<tr>
<td>E-motor SMC</td>
<td>7.5</td>
</tr>
<tr>
<td><strong>Total PM and E-motors</strong></td>
<td><strong>27.8</strong></td>
</tr>
</tbody>
</table>
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The 33rd General Assembly of the European Powder Metallurgy Association began with an address from the EPMA President, Ralf Carlström of Höganäs AB, Sweden (Fig. 2). Carlström stated that these are extraordinary times for the trade association as it transitions from its long-standing base in Shrewsbury, UK, to new headquarters and an essentially new team based in Chantilly, near Paris, France. The transition currently underway is, of course, hampered by the coronavirus (COVID-19) restrictions throughout Europe, which additionally are having a major impact on many of the events planned by the EPMA during 2020. At the time, Carlström said that a decision had yet to be made concerning the running of the Euro PM2020 Congress and Exhibition scheduled for Lisbon, Portugal, however since the General Assembly it has been announced that the event will be replaced with a virtual congress.

Carlström outlined the performance of the European PM industry in 2019, and also provided some pointers for potential growth in the different sectors covered by PM technology including structural PM parts, Metal Injection Moulding [MIM], hard materials, Hot Isostatic Pressing [HIP], functional PM materials and metal Additive Manufacturing. He stated that according to statistics collected by the EPMA, powder production for all PM applications was down 9.5% to 232,798 tonnes in
2019 compared to 2018. There was a 2.6% decrease in sales value of all PM products to €11.6 billion.

The structural PM parts sector covering ferrous and non-ferrous powders reached 196,000 tonnes in 2019 – a decrease of 11.1%, which Carlström attributed to the slowdown of car production last year. He also noted that there had been some consolidation of the structural PM parts sector in Europe, with Sumitomo Electric Industries Ltd acquiring Sinterwerke GmbH in May 2019 with facilities in Germany and Switzerland, and the insolvency of Sintertech in Isere, France in October 2019, one of Europe’s pioneering PM companies with facilities in Grenoble and St Oloron.

The trend to electric vehicles will be a game changer for the structural PM parts sector,
However, this had to be postponed because of the coronavirus and will now take place in Chantilly, France, December 8, 2020.

Dr Molins further reported on ongoing Club Projects organised by the group. The first was a three-year project started in March 2019 and managed on behalf of the EPMA by the University of Trento, Italy, on ‘Design for Sintering – Improving the reliability of the design procedure accounting for anisotropic dimensional changes’ (DIS2). The key objectives of this project were stated to be:

- To enlarge and strengthen the reference database, to improve effectiveness and reliability of the design procedure in PM
- To investigate in-depth the mechanisms responsible for anisotropic dimensional change on sintering
- To improve the accuracy of predicted dimensional changes, reducing the difference between predicted and measured dimensions to about 1/5 of the dimensional tolerance.

A second Club Project started in October 2019 and also managed by the University of Trento covers ‘High Temperature Sintering 2 – Dynamic and Impact Properties’ (HTS2). The objectives here are to properly process Ni-lean and Ni-free PM steel materials with improved mechanical properties (impact properties), as well as the manufacturing of ‘real’ parts to obtain meaningful dimensional and mechanical data of PM components and input for the design of real PM components.

A further project planned by this group but not yet underway involves the ‘Life Cycle Assessment for Low Alloy PM Steel [LCA-LAPS]’, which will be managed by Thinkstep-Sphera, Powder Metallurgy Solutions, and Powder Metallurgy Consulting on behalf of the EPMA. Here the objectives will be to quantify the Life Cycle Analysis (LCA) via an EPMA Club Project covering real high-volume powder and high-volume parts, manufactured by several companies: e.g. low-alloyed Fe powders, mixed and/or diffusion alloyed powders, so that a direct comparison to competing technologies will be possible. Parts will be subdivided into three weight classes (small – medium – large).
The aim will be to produce individual company and site reports for the powder producers and parts producers participating. The aim will be to meet the EU Green Deal, net zero carbon target by 2050. As part of this, automotive OEMs and their suppliers will be forced to prove sustainability, and must become carbon neutral (in their products and production). This will become a criterion for suppliers’ selection by the OEMs in addition to pricing and quality, stated Dr Volker Arnhold of Powder Metallurgy Solutions, Germany, who will coordinate the project on behalf of the EPMA.

This Club Project is open to new participants, and interested members should contact Bruno Vicenzi at the EPMA for more information (bv@epma.com).

**EuroMIM**

Georg Breitenmoser of Parmaco AG, Switzerland, reported on the activities of the EuroMIM Working Group, which like the EuroPress&Sinter group now covers the entire supply chain. He stated that an EPMA industry survey of European companies involved in Metal Injection Moulding showed that the sector reached a new sales high exceeding €460 million in 2019, but that sales are forecast to fall in 2020. The EuroMIM group organised a successful two-day seminar in Fischingen, home of Parmaco, in June 2019, attended by more than thirty people (Fig. 5).

**EuroFM**

Peter Kjeldsteen, leader of the EPMA’s Functional Materials Working Group, reported that on April 3 - 4, 2019, the EPMA hosted a seminar on ‘Processing of Functional Materials’ at the Fraunhofer IFAM facility in Bremen, Germany (Fig. 6). The two- day programme covered the processing of functional materials, functional materials and energy conversion, and functional material and energy storage.

Kjeldsteen added that a further seminar, ‘Applications of Powder-based Functional Materials,’ scheduled to be held at CEIT in San Sebastian, Spain, in March 2020, has been rescheduled to November 17-18, 2020. In addition to a technical visit to CEIT the new seminar will include sessions on functional PM materials in transportation, energy, medical and other applications. The EuroFM group is also preparing a promotional booklet ‘Introduction to Functional Materials’.

**EuroHM**

Dr Steve Moseley, Hilti AG, Lichtenstein, reported on the activities of the EuroHardMaterials Working Group including the preparation of a new ‘Introduction to Hard Materials Technology’ booklet, which is scheduled to be completed by the end of 2020. Dr Moseley stated that the EuroHM Summer 2020 seminar focusing on ‘Binder Phases in Composite Hard Materials’ and scheduled to be held in Aachen, Germany, June 15-16, 2020, has been rescheduled because of the coronavirus.

Dr Moseley also reported on three Club Projects currently being undertaken by the EuroHM group. The first was the ‘Micro-mechanical testing: A quantitative method for measuring local mechanical properties in hardmetals’ [Micromech II] Club Project, which kicked off in May 2019 with two objectives:

1. To evaluate sources of errors, focusing on geometry, by testing micropillars machined from small-grained samples and WC microbeams machined from ultra-coarse-grained materials.
2. To characterise the strength of WC-WC interfaces with different relative orientation.

![Fig. 6 The EPMA’s Euro FM working group organised a two-day seminar on the processing of functional materials at Fraunhofer IFAM in Bremen, Germany. (Courtesy EPMA)](image)
The ‘Simulation of Fatigue Crack Growth in Hardmetal at a Mesoscopic Scale’ (SIMU-CRACK IV) Club Project started in November 2019 and has the following objectives:

1. To study influence of the local microscopic material properties on the FCG of WC-Co hardmetals
2. To study influence of the carbon content on the fatigue property of WC-Co hardmetals
3. To further develop numerical models, taking aforementioned complementary physical effects into consideration.

The third Club project is entitled ‘Ultrasonic Fatigue Testing of Hardmetals in the Gigacycle Regime’ (UFTH 3) and was started in July 2019. Dr Moseley stated that the hard metal specimens produced by the two previous stages of this Club Project are to be characterised by SEM regarding surface and edge quality. The data obtained will be compared to those measured for the same HM grade in push-pull fatigue testing.

Dr Moseley also reported on a new European Union-funded research project called CRUSOE (Critical Raw materials sUbstitution pilOtS in pOwder mEtallurgy) in which the EPMA is participating. The contractor for the three-year project is CEA-Tech, Liten, France. Here the emphasis will be on developing alternative substitute binders for cobalt in WC-Co hardmetals because of the potential shortage and price instability of cobalt metal due to the electrification of vehicles. Alternative binders include Ni and Fe.

**EuroAM**

Adeline Riou of Aubert & Duval, France, leader of the Additive Manufacturing sectoral group, stated that the EuroAM seminar scheduled to be held in Augsburg in May 2020 has been rescheduled to December 2-4, 2020. The seminar will include presentations on existing and new AM processes, multi-material Additive Manufacturing; process chain, and standardisation. Technical visits to EOS, CAM2 and ExOne are planned as part of the seminar. EuroAM published the third edition of its ‘Introduction to Additive Manufacturing Technology’ in 2019.

The group is also planning an EPMA Club Project in the second half of 2020 on ‘Environmental Health and Safety Issues in Laser-based Powder Bed Fusion’ (PBF-EHS). Riou described the objectives of the group to include:

- Recommendations on safety procedures and safety equipment concerning dust exposure, gas monitoring, fume exhaust, material handling and static electricity
- Aggregated list of relevant safety standards available to the public.
- Description of different requirements necessary for practical and industrial use of LB-PBF, The work will be coordinated by the Fraunhofer Research Institution for Casting, Composite and Processing Technology Augsburg, IGCV.

Any member interested in joining this eight-month long Club Project should contact Adeline Riou or Kenan Boz at the EPMA (kb@empa.com).

**EuroHIP**

Kenan Boz, Technical Manager of the EPMA, stated that the EuroHIP’s seminar on ‘The use of HIP to improve safety and innovation offshore’ was successfully held in Oslo, Norway, March 10-11 (Fig. 7). Thirteen presentations and case studies were given by industry experts, with some presentations conducted online from Canada, Germany and the UK because of the coronavirus. The next seminar will focus on the ‘Use of HIP in Additive
Manufacturing’ and is scheduled to be held with the cooperation of the Technical University RWTH Aachen, Germany on March 2-3, 2021.

Boz reported that the EuroHIP group is also undertaking a Stage 2 Club Project on: ‘Combination of Additive Manufacturing and HIP’ (AM&HIP). The objectives are stated to be:

- Identification of a set of HIP parameters to obtain full density and optimal mechanical properties in components produced by Laser Powder Bed Fusion (L-PBF)
- Determination of the increase in fatigue strength that can be obtained by adding a HIP cycle to the L-PBF process
- Optimisation of the entire process chain: L-PBF + HIP in order to get a solution with minimum process costs and maximum performance regarding mechanical properties of components produced by metal AM.

This project is being coordinated by RWTH Aachen and Stage 2 is scheduled to start in the second half of 2020.

EHQS Working Group
Kenan Boz reported that the former EPMA EHQS group has been divided into three sub-groups: [1] ISO Standards [2] Chemical Management – EU legislation and legislative issues, such as REACH, and [3] Life Cycle Analysis. Boz stated that the EPMA will now be the liaison office for the ISO Technical Committee TC261 on Additive Manufacturing Standards (from October 2019) and ISO Technical Committee TC 119 on ‘Specifications for powder metallurgical materials, excluding hardmetals’. The EHQS Working Group will also include the ‘Life Cycle Assessment
for Low Alloy PM Steel (LCA-LAPS'), which was mentioned as a Club Project in the EuroPress&Sinter working group report above.

EU-funded projects

In addition to the several EPMA Club Projects which are self-financed by the respective groups of members, the EPMA is also currently involved in two EU-funded projects related to PM.

SAM – Sector, skills, strategy in Additive Manufacturing

Adelaide Almeida, Project Manager at the European Federation for Welding, Joining and Cutting (EWF) reviewed the objectives of the SAM project co-funded by the EU Erasmus Programme and coordinated by the EWF. It started January 2019 and will run until December 2022 with sixteen partners – seven from industry, six education/training and three European organisations. Almeida stated that the EPMA’s role will be raising awareness of AM through the SAM project.

The aim of SAM will be to develop modular training systems tailor-made for AM, including metal AM, and to address the future skills needed over six-month and two-year periods. Eight centres are already undertaking AM training. Areas covered include: new materials for different AM technologies; zero defect AM products; real-time process control and traceability of AM products, and artificial intelligence.

Supreme – Optimising PM processes throughout the supply chain

Thierre Baffie at CEA-Liten, France, outlined the work which has been done in the four-year ‘Supreme’ project which has run through the EU Horizon programme and which is scheduled to finish in August 2020 but which will inevitably run on for a few months because of the coronavirus pandemic. There are seventeen partners from HIP, MIM, AM, powder production and research.

Baffie outlined the four work packages in the Supreme project with demonstrators for each work package involving several PM processes; gas and water atomisation as well as mechanical alloying for metal powder production, Additive Manufacturing and near-net shape technologies such as MIM and HIP for end-part fabrication. The key focus is on reducing impact on material resources while improving energy efficiency and reducing CO₂ emissions. The project has succeeded in developing new gas atomisation technology at ASL in Sheffield. Although MIM and HIP are included, the emphasis seems to be on metal AM.

PM Life - Lifelong learning in Powder Metallurgy

A three-year EPMA project started in 2018 and coordinated by Professor Didier Bouvard, INP Grenoble, France. It involves training courses with lectures and practical work (Fig. 8), and was originally planned for five weeks per year covering modules on powders, hard materials, Additive Manufacturing, structural PM parts, MIM and HIP, with all modules available singularly. Also included is an optional three-weeks internship. The project is scheduled to end in March 2021.

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EPMA 30th Anniversary

The EPMA celebrated its 30th Anniversary in 2019, and recognised this momentous occasion with a number of events during the Euro PM2019 Congress & Exhibition held in Maastricht, The Netherlands, October 13-16.
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Metal powder recycling: Innovative technology is turning waste into resources

The reuse and recycling of metal waste in numerous Powder Metallurgy sectors has both financial and environmental implications. With the help of new technologies, such as the vacuum distillation process developed at Cronimet Envirotec, a wide range of metal waste, from metal-bearing dust to blasting abrasives and metal powder, can be returned to the production cycle again. Cronimet Envirotec recovers metal residues from hazardous and non-hazardous waste via vacuum distillation and briquetting, and here Alia Smektala explains how the process can work for metal powder-based industries.

Every day, large quantities of waste are generated by various processes during the production, post-processing and further treatment of metals. Used excess powders, filter dust and fine scrap material, as well as particles which are too big or too fine for further processing, need to be disposed of. In the Powder Metallurgy industry, at metal powder producers, at companies working with blasting abrasives, steel mills, and others, the same challenge is being faced: waste powder usually contains at least some percentage, and sometimes even 100% of metal fragments, which still bear value.

One method by which companies may attempt to reuse this material is the direct recirculation of waste powders. In addition to the risk of deflagration, however, a large proportion of slag is produced when powder and dust are used directly in blast furnaces. Many current recycling methods for metal-containing waste dusts do not represent an optimal, sustainable and environmentally friendly recycling method – resources are being lost while the waste balances and disposal costs are being increased.

For the most part, filter dusts are disposed of in landfills or incinerators. In addition to the obvious environmental impact of these solutions, this type of disposal is also becoming increasingly expensive for companies. Landfill sites are scarce, which means that disposal costs are increasing.

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Fig. 1 Waste metal powder is produced by several industries and production processes (Courtesy Christopher Burns / Unsplash)
A solution for these growing disposal problems is offered by a new technology implemented by Cronimet Envirotec GmbH in Germany. The Cronimet group is a global specialist in stainless steel scrap, ferro alloys and primary metals, and at its site in Bitterfeld-Wolfen, the focus is on treating powders and dusts so that they can be returned to the production cycle. Metal-containing dust, powder and sludges are being recycled and reused, with waste being turned into raw materials for metalworking companies.

Vacuum distillation as a solution

As a first step, sludges or powder with residues of oil and water are dried via vacuum distillation. This technology allows the company to separate all organic and volatile materials from the metal residues while working under vacuum, which prevents any oxidation of the metals. This way, the quality of the metals can be maintained and the value of the raw materials is not decreased.

The vacuum distillation production unit consists of two dryers that can accommodate tonnes of material for processing. These dryers contain rotating shafts fitted with paddles, which allow the material to be stirred continuously. This results in a gentle heat development within the material. It presents a very energy-efficient method, where the metals are being treated sparingly without a loss of quality. As soon as the contents start to move from the liquid to the gas phase, the dust is filtered from the gas, while metal residues remain at the bottom of the dryer. The gas stream then goes through a quenching and condensation unit, where water and oil are recovered.

As this process runs at temperatures above 300ºC, all undesired volatiles such as oil and carbonates, are being extracted without deterioration of the metal residues composition. Before the metal residues are removed, they are

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The materials suitable for recycling include:

- Blasting abrasives
- Contaminated metal powder
- General waste metal powder
- Filter dust
- Filter cake
- Grinding and cutting dust
- Sludges, mill scale and catalysts

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Fig. 2 Flowchart showing the vacuum distillation and briquetting process

Fig. 3 A range of materials are suited to Cronimet’s vacuum distillation and briquetting process
cooled in a cooling bunker under a nitrogen atmosphere to avoid a reaction with oxygen. After a short and intensive cooling process, the material emerges at about 60°C. The resulting material is a dry metal powder (Fig. 4).

**Briquetting technology allows metal powder recycling**

In 2019, Cronimet constructed a new briquetting facility with a capacity of 50,000 tons per year. At this plant, powders are processed into almond-shaped briquettes with a low binder content (Fig. 5). Filter dust, metal abrasives and other fine particles can be briquetted without further treatment. Other technologies often use a high proportion of non-metallic binder, which can have a negative influence on the quality of the raw materials, but during the process at Cronimet the briquette remains metallic, rather than emerging as an oxide.

The materials which are suitable for this kind of treatment are:

1. Blasting abrasives
2. Contaminated metal powders
3. General waste metal powder
4. Filter dust
5. Filter cake
6. Grinding and cutting dust
7. Sludges, mill scale and catalysts

Briquettes produced from powders, filter dust, etc, can be handled similarly to solid scrap. As the material’s quality is maintained at all times and no chemical alterations are made, briquettes can be used as secondary raw materials, closing the loops of production. This also, therefore, reduces the need to mine new raw materials. With a size of approximately 2.5 cm and an average compressive strength of 700 N (in stainless steel briquettes), the resulting briquettes are easy to handle, store, transport and feed.
into melting furnaces. Their density is dependent on the elements contained but can usually be assessed between 3.3–3.9 g/cm³. For foundries and steel mills, the use of the briquettes results in a higher yield and less slag in the smelter in comparison to the direct recirculation of powders (Fig. 6). The organic binder leaves the melting process through the exhaust system.

When processing material with a high alloy content of metals, such as tungsten or nickel, the waste producing company may be able to cut its disposal costs by profiting from reusing the material. The treatment processes described above are already being used in metal processing companies in various industries. Cronimet Envirotec offers the technology to companies either as a waste management facility or as a toll treatment service provider.

**Six steps to recycling**

1. In general, the evaluation of feasibility for a material’s recycling via vacuum distillation and/or briquetting starts with the analysis of a small sample of the waste
2. An in-house laboratory carries out a metallic analysis in order to determine whether the material can be treated. This also allows a first assessment as to whether it has a market value after treatment
3. A meeting with the waste producing company sheds light on the production process, the containers which are being used, the waste codes and logistical needs, as well as possible notification aspects to be considered. Here, the
focus lies on individuality and flexibility. A number of different containers can be used; the material can be handled as a loose filling, in containers, in drums as well as IBC or big bags (Fig. 7).

4. A pilot test with a larger sample (approximately 50 kg) of the waste at hand is conducted. In two smaller plants, the vacuum distillation and briquetting are tested before scaling up.

5. After a successful pilot test and assessment of the economic feasibility of recycling, the first delivery is organised. If the waste is handled as hazardous, a notification is needed. While the responsibility for notification lies with the waste producing company, Cronimet Envirotec offers their services to support and organise transportation, etc.

6. When the analysis and treatment of the first delivery has been confirmed to match the anticipated outcome, the collaboration can be continued. Every year, the plants are audited externally in order to ensure continued security and professionalism (ISO certifications QM 9001, EnM 50001, UM 14001, certified disposal firm).

Conclusion

Resource efficiency and sustainability are important aspects of manufacturing, not only from an image point of view, and they are becoming increasingly important in all industries. They also determine the cost structure and can contribute to value creation. Particularly due to the growing scarcity of landfill sites and the associated high costs of disposal, innovative recycling technologies represent an important step towards the vision of a zero waste industry. Thus, Cronimet’s objective is to enable the recirculation of metal-bearing powders, filter dust, oily mill scale or grinding sludges through vacuum distillation and briquetting. Previously hazardous materials can now be used as a raw material again, closing the loop for various industries.

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www.pmexchina.com

**PM Life – Additive Manufacturing Module**
August 24-28, Dresden, Germany
https://www.pmlifetraining.com/about/additive-manufacturing

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www.formnext-pm.com

**PMCC&AC Expo 2020**
September 13-15, Shenzhen Shi, China
www.pmccexpo.com

**Euro PM2020 Virtual Congress**
October 5-7, Digital Event
www.europm2020.com

**PM Life – Press and Sinter Module**
November 2-6, Grenoble, France
www.pmlifetraining.com/about/press-and-sinter

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November 10-13, Frankfurt, Germany
www.formnext.com

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February 22-24, West Palm Beach, United States
https://my.mpif.org/MPIF/Events/MIM2021

**Hannover Messe**
April 12-16, Hannover, Germany
www.hannovermesse.de

**PowderMet2021**
June 20-23, Orlando, United States
https://www.pmlifetraining.com/about/press-and-sinter

**formnext**
November 10-13, Frankfurt, Germany
www.formnext.com

**EPMA Powder Metallurgy Summer School**
July 1-3, Ciudad Real, Spain
https://summerschool.epma.com/

**Euro PM2021**
October 17-20, Lisbon, Portugal
www.epma.com

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