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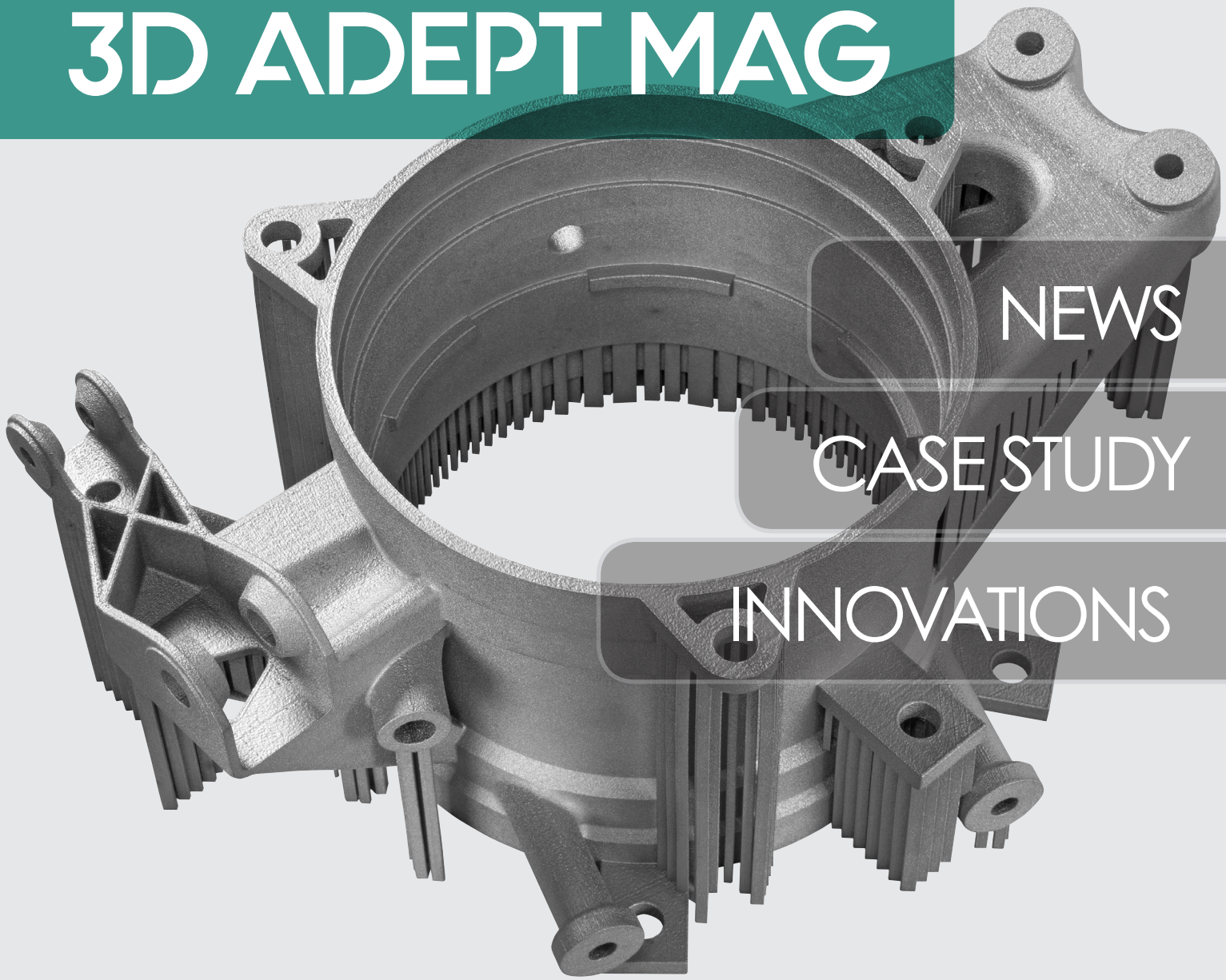
3D ADEPT MAG



NEWS

CASE STUDY

INNOVATIONS

Automotive & Aerospace

Two key sectors for metallic additive manufacturing

N° JUNE 2018

3D Adept Mag
ADDITIVE MANUFACTURING/ RAPID PROTOTYPING/
TECHNOLOGICAL INNOVATIONS

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Editorial

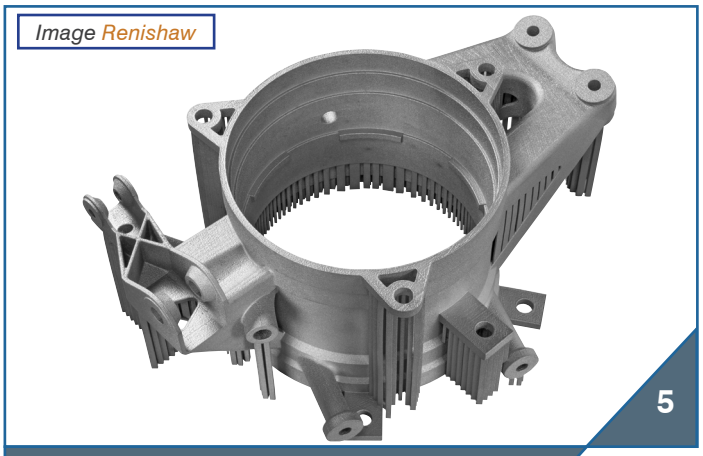
The sun is back and summer vacation is just around the corner ... as well as the first barbecues of the year. For some, the month of June equates with vacation and for companies, it will very soon be time to announce financial results. Hopefully, 3D printing will have brought you even further!

This summer at 3D Adept, the challenge will be to highlight 3D printed products during outings. A challenge that might be easy to tackle because this month marks the launch of our online store, 3dadept.shop. Various 3D printed products and 3D technologies can now have an outlet online. Manufacturers, you are most welcome to use our platform.

Going back to the latest trends in the 3D printing industry. Believe it or not, the month of May was strongly marked by projects and innovations in the automotive and aerospace industries; which is a nice coincidence because the issue of this month highlights additive manufacturing in those two sectors. Once more, we have had the pleasure to meet inspiring participants that have enlightened us in a thousand ways. Thank you for your contribution! Most of you can't wait to read this dossier, so we hope to meet your expectations.

I shall not keep you any longer ...Delve in!

Kety Sindze, *Editor in chief*



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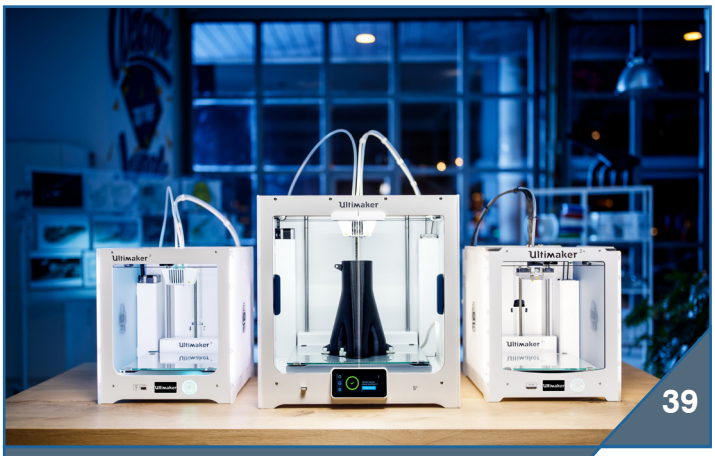

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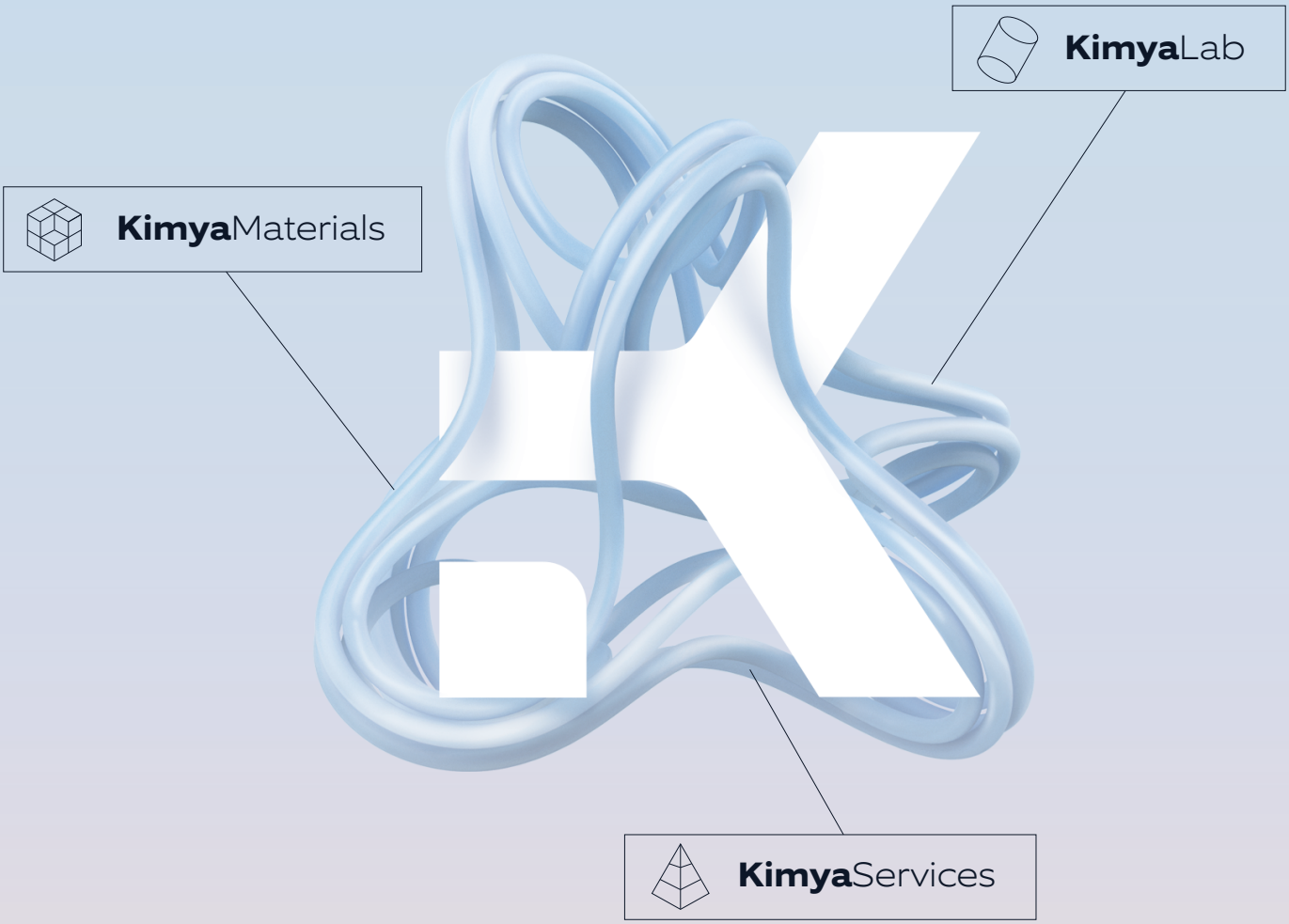
A 360° VISION
of your 3D printing project



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Automotive & Aerospace :
two key sectors for metallic additive manufacturing

In addition to the medical sector, market reports, corporate reports and even media reports reveal that the aerospace and automotive sectors are currently the most demanding sectors in the additive manufacturing market.

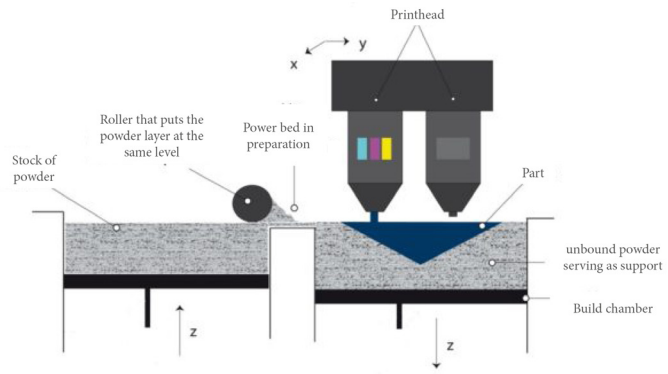
Surprisingly (or not), of all the technologies used in these industries, the Wohlers Report 2018, announced a “dramatic rise in metal additive manufacturing and overall industry growth of 21%».

The growth of such technology, its impact in these two sectors still raise some questions regarding its potential, its use and its limits within the industry. That’s the issue we decided to tackle this month with the participation of Benjamin Denayer (Sirris), Dr. Martin McMahon (Renishaw), Kay-O Kissling (3D Systems for Aerospace), Michael Sattler (3D Systems for Automotive), Delphine Carponcin (Airbus) and Frank Götzke (Bugatti).

1.Metal additive manufacturing (AM) in a few words ...

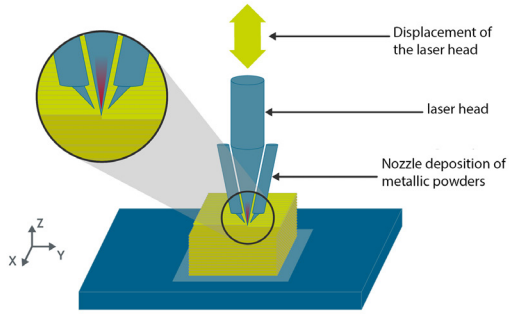
Metallic additive manufacturing is based on the use of two main technologies: ***Powder Bed Fusion process and Directed Energy Deposition (DED).***

Simply put, in the first case, an electron beam or simply a laser will melt or sinter a narrow layer of powder. The second layer will then be deposited and melted or sintered onto the former layer.



binder projection process – Copyright : CeAI

In the case of Directed Energy Deposition (DED) on the other hand, the laser used will melt metal powder brought into the laser spot and this melted material will be projected on the object surface. Once melted, the powdery material forms a layer that will fuse with the substrate.



Directed Energy Deposition - Copyright : Mécastyle

What type of metal additive manufacturing technology is most widely used in the automotive and aeronautics sectors?

For Benjamin Denayer, Senior Business Developer Additive Manufacturing at Sirris, LBM (laser-based manufacturing technology) is the most widely used type in both industries.

Known by various names (in this case, powder bed fusion process), Benjamin Denayer explains that, in addition to LBM, "other technologies, such as WAAM (Wire Arc Additive Manufacturing) are drawing much attention in the aeronautics sector. This technology can, indeed, construct bigger structures; is faster but less accurate. Today, building surfaces are essentially constructed with measurements of 350x350x350mm and not all applications can be printed on such printers. 3D printers' manufacturers are investing in research and building bigger printers and maybe someday, it will also become cost efficient for bigger parts."

Benjamin Denayer, Senior Business Developer Additive Manufacturing at Sirris

What are the recommended materials for each type of technology?

Both types of metal additive manufacturing require the use of materials that are relatively diverse.

Powder Bed Fusion process or sintering technology

In general, metal, plastic or ceramic powders are used with this type of technology.

Metallic powders - © DR

In terms of specificities, the powder bed fusion process «allows to build layers that are strongly linked to each other." The reality is that each time a layer of material is fused or sintered, the layers that are lower and closer must recast to show a strong cohesion.

AM based on Directed Energy Deposition

The properties of a part obtained by laser melting will not be far from the characteristics of this part obtained by forging or casting. The importance of materials therefore also has a crucial role. These materials are iron, cobalt, nickel, aluminum, «all metallic materials that can be fragmented into spherical form.»

Note that despite this variety of materials available on the market, each company has its own preferences. Airbus, for instance, mainly uses Titanium and Aluminum for the manufacture of its parts while 3D Systems, in its offering to companies in the automotive and aerospace sectors, offers the possibility to manufacture parts in Titanium, Stainless Steel, Cobalt-Chrome, Aluminum Alloy, Maraging Steel, Nickel and Super Alloy materials.

Metal 3D printed part of an auto manufactured with 3D Systems ProX DMP 320

However, **Benjamin Denayer believes that in the current state of the market, the full range of materials that can be used in both business sectors is not fully exploited.** *"There are still a lot of possibilities on materials. Today, some materials are not yet printable and could be an issue. But again, when you are looking at the aerospace sector, a lot of titanium and aluminum is already used. For aerospace and automotive, there is already a large number of materials available that could work. Maybe if we look into other sectors the limits of materials are more critical but for these two sectors, not really."*

Professionals' tendency to compare additive manufacturing (AM) materials and materials used in material removal manufacturing methods

Most of the time, in order to better understand the use of additive manufacturing technology in a given sector, engineers tend to compare it with conventional manufacturing methods they know best. Dr. Martin McMahon, Business Development Manager, Additive Manufacturing Solution Centers at Renishaw, draws attention today to this type of comparison with materials:

"Most people say: "how can AM materials be compared to materials used in traditional technologies?" You can make comparisons but you can never make them the same. Engineers are used to designing whilst taking into account the properties of materials for conventional techniques. For many years, engineers have been somewhat suspicious about metals produced by laser powder bed fusion, partly because of the misunderstood use of the words "laser sintering", which is now falling out of use in favor of powder bed fusion. Most materials produced by laser powder bed fusion now exhibit mechanical properties close to standard wrought materials and attention is turning to the ability of the AM systems to consistently produce parts at an acceptable quality, backed up by sensor-based process data. Just like casting, which was only adopted in high technology manufacturing once a degree of confidence in the consistency of the process was achieved, AM will follow a similar if accelerated route, backed up by intelligent process monitoring tools and, the great number of research projects that have been carried out to understand these properties to enable people to confidently use AM components. There are still limits but a growing confidence in the data is fostering the adoption of AM materials by big companies today in production."

Before discovering the specificities of each sector of activity, let us determine the similarities and differences that link both automotive and aerospace sectors.

build chamber- Metal 3D printed part of an auto manufactured by Renishaw

2.Automotive and aeronautics: two closely related and yet very different sectors

For Kay-O Kissling, Sales Manager Aerospace - EMEA at 3D Systems:

"In the automotive sector, it is not only about the supply chain, but also about cost, time-to market, and the ***complexity which lies in the feasibility of the process compared to traditional ways of manufacturing.***

However, for the manufacture of aeronautical parts, lightness and part performance are two main focuses.

Another difference between both sectors is that in the automotive industry, a great deal of the 3D Printing application is prototyping parts for fit, form and function testing.

Lastly, ***a key difference is documentation****. The aeronautic sector has the highest documentation. Everything must be certified, verified and traceable by the aviation authorities. The qualification and the certification by the authorities are the key challenges of this sector."*

2.1. 3D printing in the aerospace sector: «to be lightweight to fly more efficiently»

Additive manufacturing has seduced the aerospace industry for several reasons. It is easy to chiefly look at the production of parts and the fact that 3D printed parts easily withstand the high temperature requirements of aerospace, but the contribution of 3D printing goes far beyond this point.

Kay-O Kissling, Sales Manager Aerospace – EMEA at 3D Systems

For Kay-O Kissling, "3D printing contributes to the aerospace sector on 2 major axes:

- When considering printed parts, 3D printing improves the part performance, brings a new design and pushes the limits of light-weighting. It also highlights the customization and consolidation of parts.

- Another major contribution to consider is the "commercial aspect". Commercial aviation is the most extreme example here given its very long and complex supply chain. What 3D printing offers is the possibility of reducing the complexity of the supply chain (by enabling to gain more transparency in the supply chain) and offering a shorter time to market in regards of the production time. 3D printing also lowers the risks in the supply chain for the commercial aviation sector."

Delphine Carponcin, Product Development Engineer at Airbus, joins Kay-O Kissling on certain points such as the lightness of the part. If we had to determine whether additive manufacturing (AM) is more advantageous than traditional manufacturing methods (especially those by removal of material), the lightness of the part manufactured using AM would therefore be considered as an advantage.

Kay-O (3D Systems) specifies that if we have good results in terms of part consolidation, « in terms of feasibility, a lighter part does not necessarily mean that it is more performant.

And even yet, 3D printing is a process more expensive than the conventional manufacturing methods for medium to high volumes. So, if you have a small part to bring to mass production, 3D printing will not necessary be the best business model."

Metal 3D printed part manufactured by 3D Systems for Thales

The comparison in terms of «costs» includes another aspect at Airbus:

Delphine Carponcin explains while talking about the experience of Airbus in the sector:

"That there is a gain in mass, because one can manufacture optimized geometries.

As far as manufacturing times are concerned, for the time being we are equivalent to conventional techniques because additive manufacturing also involves a lot of control and verification. The more mature the technology is, the more control time will reduce. In the long run, we might certainly reduce the

delivery time of parts.

In terms of cost, the comparison really depends on the type of part. If we compare one by one, another advantage of the ALM (Additive Layer Manufacturing) is left apart: the possibility of creating parts that are not possible with machining. Moreover, there is certainly a cost advantage when it comes to manufacture several parts in one.

However, attention is to be made on the cost analysis which must be done according to families of parts.»

Delphine Carponcin- Development Engineer at Airbus

As far as mechanical characteristics of parts are concerned, at Airbus, *"Titanium parts have mechanical properties that are equivalent to other metal properties. For aluminum, certain series of alloys can be compared. A 4000-aluminum part obtained by ALM integrates properties that are similar to a conventional aluminum part.*

In other words, when we use the same properties and the same alloys as traditional technologies, we will have mechanical properties that are close but aluminum will require the use of a specific alloy to be able to use it in the additive manufacturing.

Lastly, at the very beginning of the design phase, a particular attention should be paid to the "santé matière": metal parts in ALM are still characterized by a slight porosity, which must be taken into account in the analysis and assessment of an alloy or a part."

2.2. 3D printing in the automotive sector: «Good bye conventional methods, hello mass production?»

If the aforementioned benefits of metal 3D printing are the same for the manufacturing of cars, Michael Sattler, Direct Sales Manager, DACH, 3D Systems, confirms that metal 3D printing is also being used in the manufacture of low volume automotive applications including classic car spare parts and racing car parts.

However, the challenge in automobile *"lies in designing a part so performant that it covers multiple functions and its complexity therefore requires additive manufacturing to produce it."*

Michael also explains that, for now, it is not yet possible to produce single frame large parts for cars unless they are connected together. The largest build volume we offer right now is 500x500x500 mm. He adds that it is essential that the software, printers and metal materials are completely integrated for automotive applications to ensure print success.

Pulley of racing cars – 3D Systems

Frank Götzke, Head of New Technologies in the Technical Development Department at Bugatti Automobiles S.A.S, agrees with **Michael** on the production time. The truth is that for our two experts, the current cycle times for 3D printing are far removed from the cycle times of technologies used for large-scale production. For example, forging or die casting takes only a few seconds of cycle time while 3D printing requires several days.

To talk about a specific case at Bugatti, Frank G. explains that they use *«this technology for the Chiron prototype cars and also for the current production car.»* The company uses materials such as UMS (Ultra Modulus Strength) carbon fiber, high strength titanium alloys, high strength steel alloys, high strength aluminum alloys, and carbon ceramics. However, no limit is observed for the small quantities they need.

Michael Sattler, Direct Sales Manager DACH at 3D Systems

Frank Götze shares with us a particular case of the use of 3D metal printing in the manufacture of one of their parts:

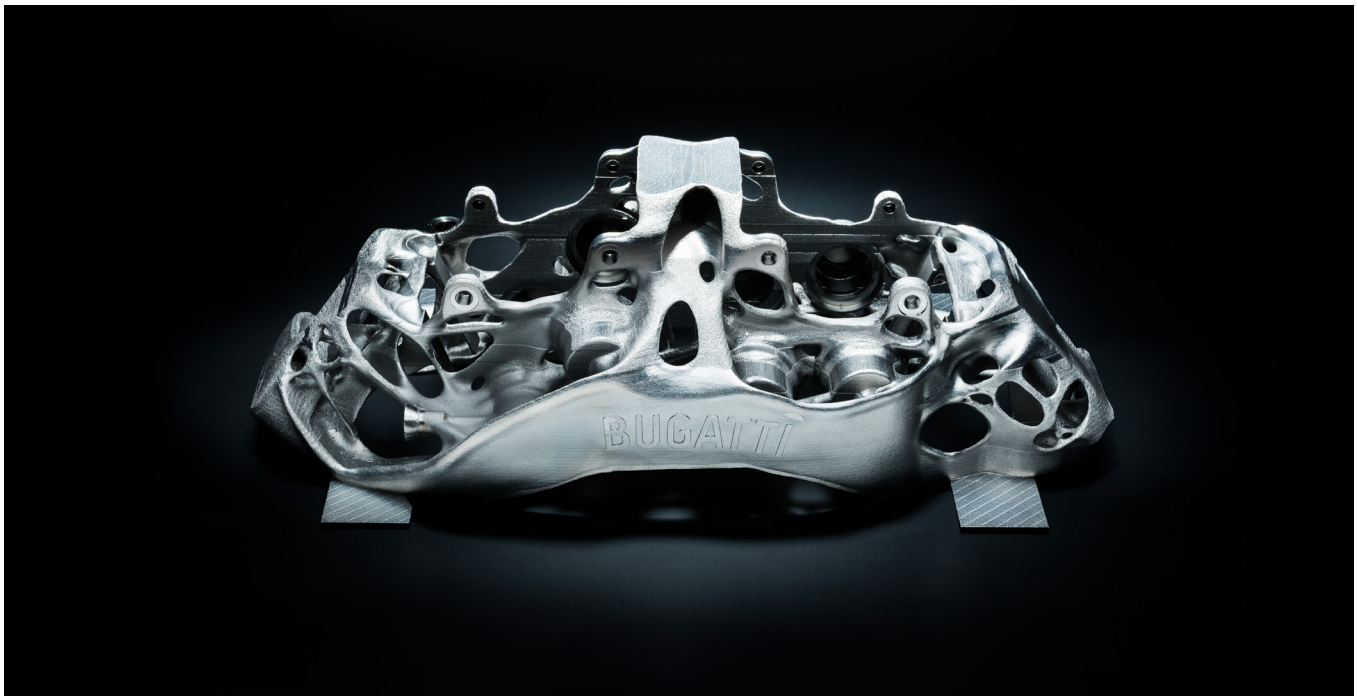
"We developed a little mounting bracket with an

integrated water cooling circuit which makes it possible to reduce the temperature of the electric gearbox shifting pressure pump by 40°C. This part was printed out of an aluminum alloy because no bigger tensile strength was needed here. For parts where a higher tensile strength is needed, such as brake calipers or wishbones, the only material suited for 3D printing is titanium which reaches a tensile strength of around 1,250N/mm2."

Ultimately in the automotive industry, we are still far from producing volume parts with 3D metal printing.

For Frank Götzke, "Even if experts find that additive manufacturing technologies are 10,000 times faster than today's technologies and are able to work with high-tensile alloys made from any material needed, there will always be the need for precision machining and finishing through cutting production technologies like for instance turning, milling, grinding and honing."

Frank Götzke



Brake caliper by Bugatti

3. In a nutshell, what have we retained?

Based on our analysis and the different stakeholders' contributions in this dossier, the following advantages and focal points can be brought out:

Advantages and focal points in the aeronautics sector:

Advantages
Lightness and performance
Possibility to build several parts in one
Freedom in design
Attractive metallic additive manufacturing to adopt for the manufacture of unique parts.

Focal points
Attention is to be paid to the "santé matière": It is important to know the properties of a material, its defects and strong points
Manufacturing time more or less equal to traditional methods for now
Large parts are manufactured in an open space, with other 3D printing systems.
Metallic additive manufacturing is still expensive: difficult to adopt for mass production

Advantages and focal points in the automotive sector

Avantages
Lightness and performance
Predominant use of prototyping
Highly efficient 3D printed parts

Important Notes
Need of materials that can be welded
Mass production is not yet possible
Production times are a crucial point
Expensive technology

Conclusion

In the end, the experts remain positive on the integration of 3D metal printing in the production processes of the automotive and aerospace sectors. However, each of these sectors has its own set of points that must be taken into consideration, in terms of certification, materials used or even production time.

If there is no longer any doubt about the effectiveness of metal additive manufacturing in the automotive and aerospace industries, one should keep in mind that it is a complementary technology to conventional techniques. However, one question remains unanswered: «**Will metal AM be ready for mass production someday?** ».

HOW AUTOMATION SOFTWARE ENABLES HYUNDAI MOTOR TO IMPROVE ITS PRODUCTION EFFICIENCY?

This month's dossier raises awareness again on the importance of prototyping in the automotive industry. A closer look at it reveals that it is exactly where 3D printing began. Car manufacturers increasingly reconsider their manufacturing method in order to offer better products. Hyundai Motor Company for instance focuses on cars that have a better performance and higher safety.

But how does the company effectively manage its additive manufacturing (AM) production?

Hyundai Motor Corporation has reconsidered the way it handled its construction planning to keep a global view of all the build statuses and to ensure that all stakeholders receive the information on time.

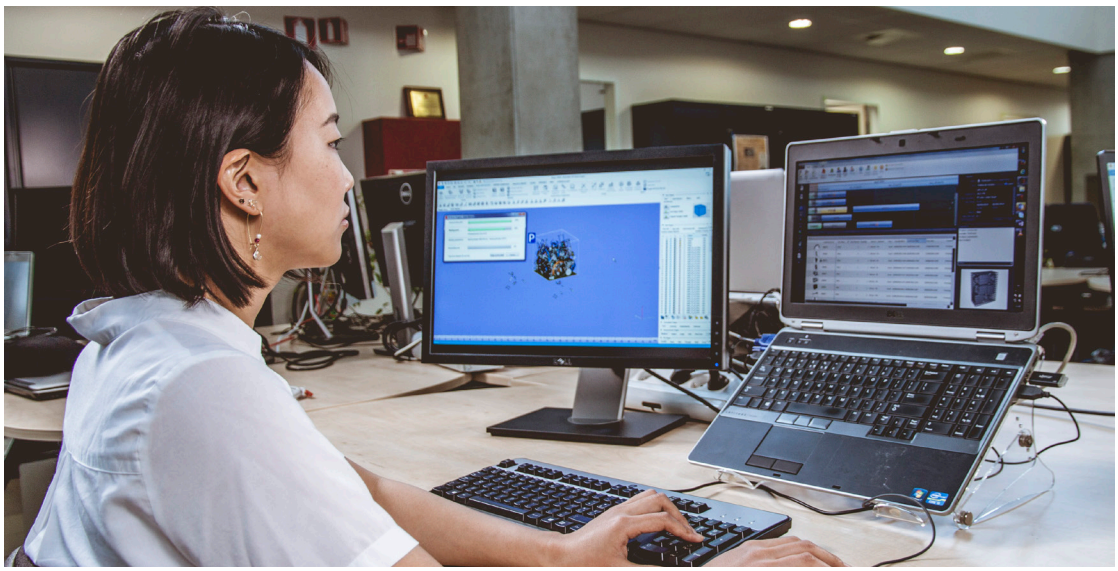
Prior to this change, the company used Excel sheets to manage the RP production status, which involved regular and manual update of information. To keep track of the number of parts produced, the savings and other operating data, they manually generated reports. Furthermore, a lot of time were invested to manually manage each machine's operating plan, update and communicate planning as soon as changes occurred.

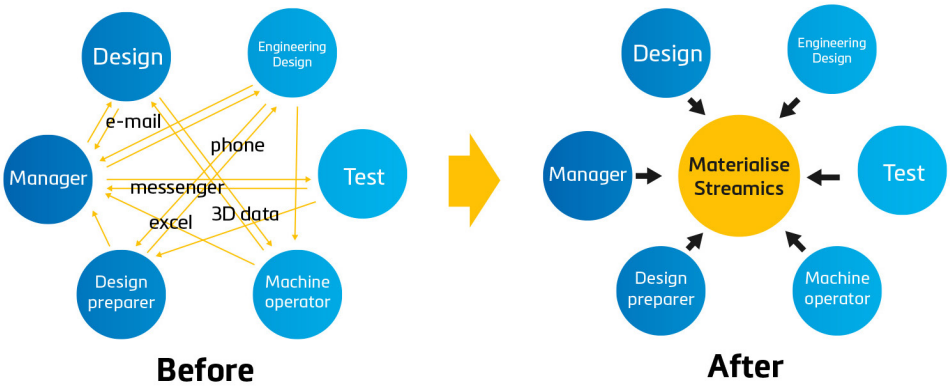
The company absolutely had to find a way to save time and above all, to automate its planning, hence the introduction of Materialise Streamics.

Materialise Streamics

"Materialise Streamics is a production management system that gathers all kinds of information (order info, machine info, part info etc.) and automatically updates the production status in real time."

The system enables the car manufacturer "to extract customized reports about production, sales, management, and quality. When the production schedule changes, managers and machine operators can easily adapt the planning in real time."





In addition, information dissemination has changed. They are now stored in a central database. The latter is the connection point between data preparation, production, post-processing and management. Every stakeholder can now follow the real-time progress of production planning and the status of each machine. Thereafter, the system automatically informs them once the build is done.

What do statistics show?

According to statistics, the transition from manual labor to an automated system has allowed Hyundai Motor Company **to reduce working hours by 77%**. Since employees work more efficiently, customers receive a better service.

In addition, before using Materialize e-Stage, the company spent a lot of time in manual planning but even more in post-processing to compensate the poor surface quality after support removal.

From now on, *"the automatic support generation software generates support only where needed, saving material (13%) and reducing data preparation (94%), build (30%) and post-processing time."*

Last, **On Han Woo**, Senior Research Engineer, Proto vehicle development team, Hyundai Motors explains that the software enables to get an efficient and optimized support generation. It also "led to lower material consumption, better part quality and faster support removal. This means we can spend more time on creating an added value for our customers."

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3D PRINTING OF SPARE PARTS : A COST-EFFECTIVE SOLUTION FOR THE MASS PUBLIC?

Every day, the benefits of 3D printing are presented in the health, architecture and aeronautics sectors. There is also a growing introduction of technology in schools. All this may seem far away for the average consumer. And yet, he/she has the ability to print basic objects that are used on a daily basis.

3D printing of spare parts or objects of everyday life is becoming more and more common in everyday life. The initiative is gaining momentum with the ***«Do-it-Yourself»*** movement or the «maker» movement. The truth is that the maker, through his/her creative skills, touches everything and quickly takes his/her marks with new technologies.

In addition, with the increasing decline of 3D printers, the maker prints more and more objects that he uses daily or repairs the damaged objects of everyday life: a cabinet whose seal is broken, a new plate to put a poached egg on or just the heel of a pair of shoes.

This is why we note the growing presence of market places dedicated to 3D models. In this register, we note in particular **CGTrader** or **Cults3D**.

For your info, CGTrader is founded in 2011 by the 3D designer Marius Kalytis. The platform offers 3D printable models in all sectors of activity: electronics, decorative items, kitchen, cars, and many more.

With more than 2000 specialized designers, Cults connects 3D model creators with those who want to 3D print an object. Founded by Hugo Fromont & Pierre Ayroles, the platform offers 3D models in various sectors of activity: art, fashion, home, architecture and many others.

Speaking of the importance of designers in everyday life but especially in the 3D printing market, the two co-founders affirm that: *«in the end, it is thanks to them, to their 3D models, that 3D printing will be a success tomorrow, that everyone will want a printer because without their models, that are ingenious, very beautiful, the public would not want to have a product and the makers to buy a 3D printer in order to produce them.»*

3D PRINTING OF SPARE PARTS: A REAL BUSINESS

Besides the maker movement, other entrepreneurs have really founded and established real businesses.

The French brand Boulanger specializing in leisure, multimedia and home appliances set up the Happy3D platform. The platform encourages the «Do It Yourself» by allowing consumers to extend the technology around them, allowing them to enjoy their products. Through a collaboration with Cults 3D, Boulanger aims to foster the use of 3D printing for home appliances and multimedia.

At the launch of the platform, Gaële Wuilmet, Director of Bakery Services & Innovation and Director of B'Dom said that Boulanger launched this «OpenSource» approach by publishing the plans of its own exclusive brands and wanted big international brands to join its idea.

In the event of a breakdown, our customers can now download the part to be changed and freely produce it using a 3D printer. To compensate for a still low equipment rate, Boulanger also offers its customers to put them in contact with 3D printer's owner close to their home and offers in addition, a 3D printing training via BDom.

Finally, one thing is certain, printing spare parts extends the life of products used every day. While this is a cost-effective solution for some, it does not stop technology addicts from getting the latest device releases.

However, Boulanger will not remain the only company to offer such a service. Stay tuned ...

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A common space, a complete solution around 3D

It is a spirit of unity that draws us today to Liège (Belgium), precisely to the Pôle Numérique 3D. Gathered in a common space, the collective of companies specializing in new technologies aims to offer a complete solution in 3D to their present and future customers.

One of the achievements that inspired the creation of the Pôle Numérique 3D is a model of Liège in 1730: the work of Gustave Ruhl which was exhibited for the first time in 1906. Three members of the Pôle (DO Design Studio, Design Stone and IdeaTo3D), worked on its restauration: the work of art was 3D scanned, redrawn in 3D and molded into a sculpture before being cut into 200 pieces for the anniversary of the University.

Following this collaboration, the group is officially formed and decides to welcome companies that are specialized in their respective sector of activity. To date, it has 9 members:

First, **D.O. Design Studio s.c.s.**, founding member, specializing in computer aided design and high-resolution 3D scanning. Olivier Defêche is the founder of this company. It supports the entire design chain.

Design Stone s.a.: the company specializing in CNC machining (all materials) within the marble industry. It is known for its ability to combine both stone and fire to achieve personalized creations.

Then comes Minimoi Belgium. The Swiss company based in Liège has been putting smiles upon the public's face for a few years now with its body-scanning and printing service.

Then, **IdeaTo3D**. This Ultimaker representative offers a 3D wire deposit service.

Gecko Company will bring its expertise in environmental 3D laser scanning.

HD4U created, by Fabrice Hamblet and Frederika Dewageneer, adds value to 3D scanning projects through skills in aerial image capture.

Fabrice Hamblet & Frederika Dewageneer

The Pole remains open to welcoming new members if they propose an area of activity that belongs to the 3D sector and which is not yet covered by other members.

Olivier Defêche tells us that many projects are underway. Some are made for the **Saint Lambert Museum**, others in collaboration with the **University of Liège** ... #StayTuned

RH Medias offers virtual 3D tours within the cluster thanks to its Vision3D service.

Finally, in addition to the **4D Management** surveyor's office, the Pole also hosted B71, a company specializing in video games, virtual reality and augmented reality.

ON THE ROAD TO EDUCATION

3D printing courses for aerospace professionals

Companies are looking for skilled labour in additive manufacturing technologies at an increasing rate. To encourage students, they participate in projects organized as part of their university studies to discover potential talents. Others, such as GE Additive, Ultimaker, and Makerforged, have implemented programs to directly enable teachers and students to learn more about this technology. In the same vein, BMW Group has decided to invest 10 million euros in an additive manufacturing campus. All these initiatives are highly appreciated by the public as it prepares the students who will be the professionals of tomorrow. But the question still stands, what about today's professionals?

The reality at face value is that companies in the sector are setting up initiatives for the world of tomorrow and yet today's professionals also face difficulties in controlling additive manufacturing in their sector of activity. This reality is very much understandable as the implementation of 3D printing is done gradually in the industrial sector.

However, in the aerospace sector, MIT and Boeing have just taken their first steps in such type of training.

For the duration of 9 weeks, professionals and organizations will discover and gain new additive manufacturing skills through online courses. Participants will learn new concepts in the design, production and service of products. In addition, they will research the techniques of restructuring workflows and lowering manufacturing costs.

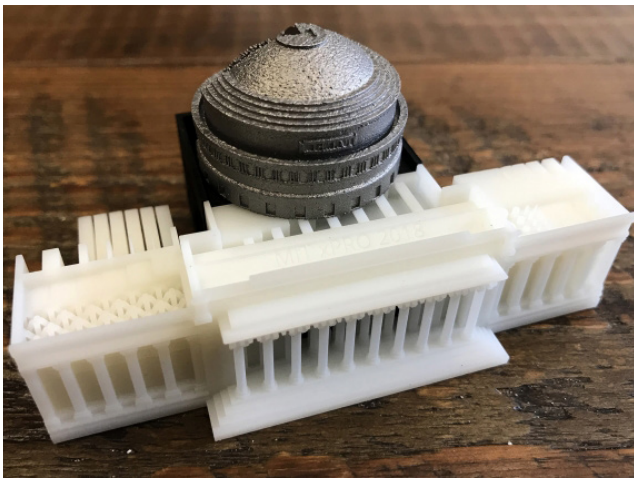
"The new course teaches critical skills that prepare employees to implement AM in their organizations. The course explains leading AM technologies for polymers, metals, and advanced materials; addresses design for AM via both engineering principles and computational design; and includes quantitative models for assessing the cost and value of components made by AM."

The purpose of the MIT-Boeing collaboration

The two companies aim to communicate the reach of 3D printing and its ability to increase productivity in manufacturing operations. This applies to aerospace and potentially to any industry involved in the design and manufacture of physical products. The course syllabus reflects the widespread applicability of AM across industries.

"Additive manufacturing already has important implications throughout the product life cycle, yet, most importantly, we can now envision its use as a mainstream production technique. This compels us to accelerate our understanding of

the unique advantages of AM, and rethink how we design new parts and products, and the metrics by which we define their importance," says the course director, John Hart, associate professor of mechanical engineering at MIT and director of the MIT Laboratory for Manufacturing and Productivity.



«Leading by example»

Since last year, Boeing has grown with its use of 3D printing in the manufacture of its parts for aeronautics.

This enabled the company to earn a reward with Norsk Titanium for qualifying titanium 3D printed parts for a commercial aircraft. In addition, other partnerships have been signed, notably with Oerlikon, for standard processes for structural aerospace in titanium printed in 3D.

To date, the aerospace company has more than 50,000 3D printed parts on commercial, space and defense programs. Since the creation of **Boeing Additive Manufacturing** in 2017, the company has focused on using additive manufacturing to generate value for customers.

Thus, Boeing leads by example because by partnering with MIT, the American research institute and a university, specializing in the fields of science and technology, the aerospace company increases the skills of professionals who are already at the heart of additive manufacturing in the aerospace industry.

Between fundraising and investments: an update on the expenses of the additive manufacturing market

Earlier this year, International Data Corporation announced in a half-yearly report that expenses related to the additive manufacturing market would increase by 19.9% over 2017 and reach $12 billion in 2018. We are now in June, 6 months later, and the market did show huge expenditures but also huge investments. Let's try to understand why and how.

The market is changing, so are the needs of companies. In Europe anyway, investments are easily observed and seem to be as easy as buying a baguette at the bakery. Why?

Because there is a strong demand in the market. The market needs service providers. The demand is still, for now and in some areas, higher than supply. That's why companies create the offer. To put it concretely, and to speak about numbers, Siemens is expanding an offer with an investment of 30 million euros.

The plant, which will be set up in collaboration with Materials Solutions Ltd, will double the company's current footprint and bring the number of its 3D printing systems to 50.

Materials Solutions Ltd develops and manufactures turbomachinery parts for gas turbines. Siemens acquired the majority stake in the company in 2016.

There is a need and an interest on the part of the public. We tend to forget about it, but people like you and us benefit from industry solutions and fabrications.

Sometimes, these people do not have a great interest in the way their solutions are made and implemented but a certain percentage of interested people, professionals from other sectors of activity who can also exploit additive manufacturing, makers or students are interested in the 3D technology and want to know more. In this mixture of people, companies decide to invest because they constitute a real added value.

BMW Group, for example, will invest 10 million euros in an additive manufacturing campus. Located in the north of Munich, including Oberschleissheim, the campus activities will focus on the manufacture of parts for prototype construction, mass production and custom solutions. The center will also serve as an interdisciplinary training and project space for development engineers.

The advantage in these two arguments is that companies also in some way contribute to their development and to a certain extent to the development of the country's economy through the creation of a

skilled workforce.

In the case of Siemens, for example, more than 50 new high-quality jobs in Worcester should be created for the proper functioning of the facility. Siemens aims to develop a global business with 3D printing for growing sectors such as aerospace, automotive and other industries.

As for BMW Group, it must be acknowledged that the automotive specialist is setting up a campus that is not like the others because it is not focused on training but on production, the aim being to combine the additive manufacturing with existing techniques. The truth is that the company expects that over time, «it becomes possible to produce components directly where they are ultimately needed».

In early 2019, when the activities will begin, the campus will still be able to accommodate up to 80 associates.

What about fundraising?

With fundraising, the principle is almost always the same: to call on investors to ensure the development of a company in the long term, the launch of a product or the entry in a new market sector. We are no longer talking about a simple crowdfunding campaign that involves donors here and there who receive a copy of the product on which they have invested. We are talking about a much larger sum of money that requires the introduction of new stakeholders in the capital of a company.

Well, it is also a method widely used by the actors within the additive manufacturing market to develop their business.

In this market, among the fundraisers that have marked us since the beginning of this year, we note that Create it REAL, the Danish center of R&D specializing in 3D printing technologies recently closed a fundraising of 1,3 million euros.

This company founded in 2009 by Jeremie Pierre Gay, conquered the market in 2013 when it launched the first real-time processor dedicated to 3D printing. The company claims that its patented technology has a print speed of up to 5 times faster than traditional FDM printers on the market today.

For Jeremie, this is a strong argument when customers realize how slow 3D printers are, and of course they can print faster with the same quality, without compromise. Their goal today is to expand their development team and create greater visibility.

In addition, the manufacturer Formlabs has also appealed to investors including Tyche Partners to penetrate new markets. With 30 million dollars, the manufacturer now wants to conquer the Asian market, especially China after a notoriety that needs no further discussion in Europe and the United States.

For the moment, it is still difficult to say if all these fundraisers are necessary for each company. However, it is undeniable that the results in the economic growth of the market are only encouraging.

Finally, here we are dealing with a simple sketch of the potential for fundraising and investments by additive manufacturing stakeholders in the 3D printing market. Can we say without any doubt that the 2018 expenses will be higher than those of 2017? There are still 6 months in the year before making the final summary. **It is certainly a case to follow ...**

Add Fab

a second successful edition!

On April 11th and 12th, 2018, Add Fab welcomed for its second edition, the actors of additive manufacturing. Unlike last year when it was organized in conjunction with the fair dedicated to graphics, this year, its organizers decided to "go it alone" to show that 3D printing is a value and potential in the business model of many business sectors.

This is a successful bet because the number of visitors has increased considerably and exhibitors have offered a range of products and services that are equally interesting to each other in their sector of activity: upgradeable 3D printers for makers, 3D printers professional pellet mills, some industrial 3D printers, materials specialists, software vendors and even 3D printed object manufacturers.

The event was accompanied with conferences, company presentations and the highly anticipated «pitch start-up».

So, what can we retain?

We especially appreciate the presence of companies that exploit the potential of 3D technology to make their 3D printed objects. The presence of these companies that exhibited only 3D printed objects has allowed the average visitor who discovers the technology, who does not yet know which path of additive manufacturing he must take, to have more tools to evaluate the benefits and the limits of this technology for its industry. On the other hand, it draws his/her attention to the process of making an object that he/she uses every day. These companies include the Octobre 71's 3D printed glasses, OWA speakers and Endeer bra.

In addition, for the second time, the show also decided to renew the «Pitch Start-ups 3D» challenge. To determine the most innovative start-up in the sector, 10 companies presented their products and services in different sectors of activity such as medical, optics, automotive and fashion.

The latter sector was honored by Endeer, who won the challenge. As mentioned above, the French start-up has seduced through a lingerie made using 3D printing. Founded by Claire Chabaud, Endeer has a custom frame. For the French start-up, it is essential that the lingerie is created from the body of the woman who wears it and not standards.

With the occasion of the Pitch Start-ups 3D, Endeer receives from F3DF, Autodesk training and certification center and design product design, BIM and 3D printing, an Autodesk Fusion 360 pack (worth $ 3,000 overall) including 1 license Autodesk® Fusion 360 ™ 1 year, 1 training 35 hours Elearning, 1 certification exam ACU Fusion 360, 1 formation 3D Printing by the reference F3DF as well as a strategic accompaniment of 6 months dispensed by the company. This support aims to offer F3DF's expertise and network in the field of additive manufacturing.

In addition to 3D printed objects and Pitch Sart-ups 3D, we note the growing importance of additive manufacturing platforms and 3D software in the French market. The companies 3YOURMIND, 3D4PRO, and CoreTechnologie are some of the companies that have presented their products and services in this sector. You will be able to discover their interviews-videos on the online media of 3D Adept (www.3dadept.com).

Finally, if this second edition was successful, it also remains marked by a minimum presence of companies that offer industrial 3D printers. The third edition may change the game in this sector of additive manufacturing. See you next year to discover it ...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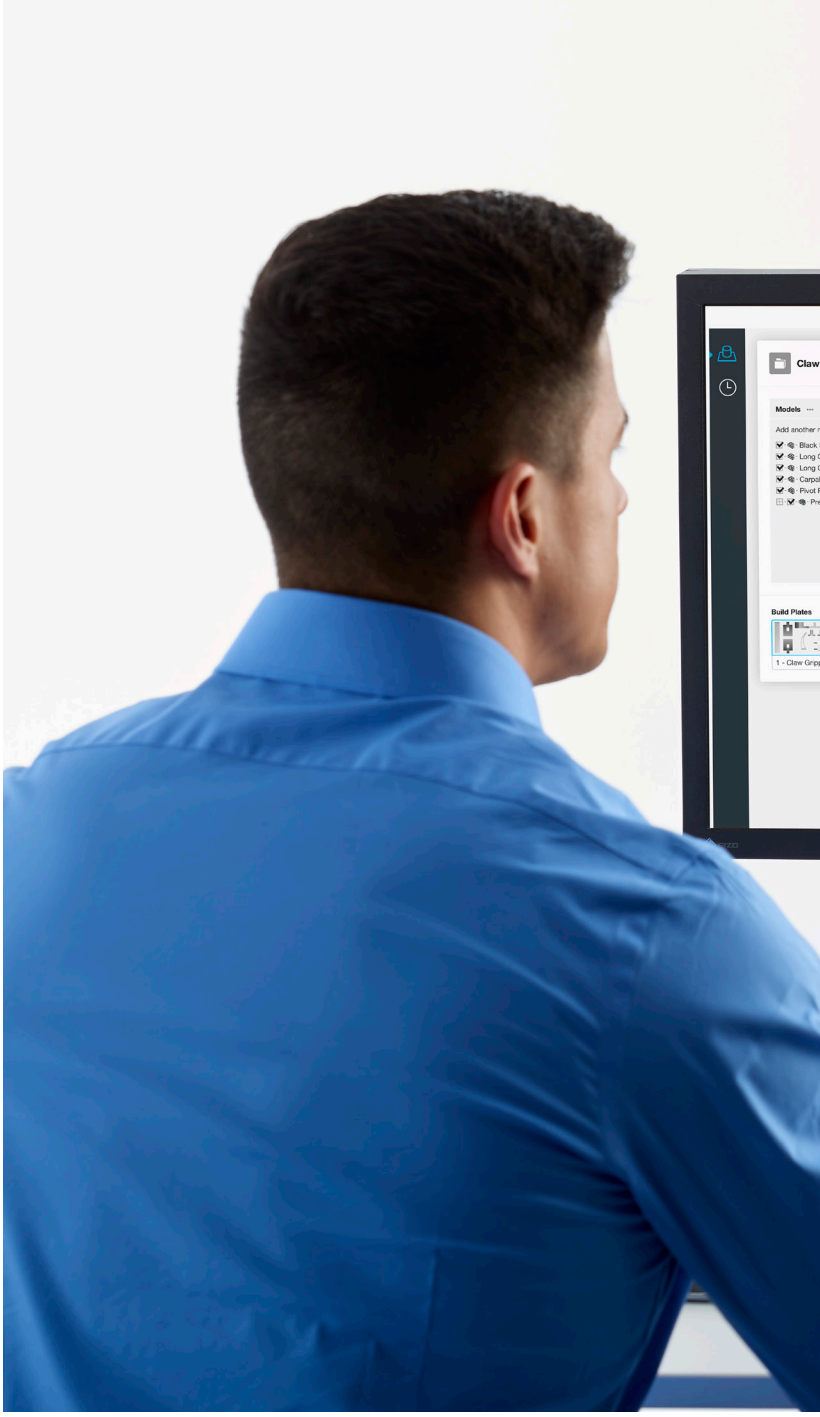
ARE YOU LOOKING FOR WORK? 3D PRINTING IS HIRING!



Many of us have known (or know) all the pressure someone might have in his/her search for job. A pressure that often goes through several phases: having the ideal CV that attracts first by its beautiful presentation, the ideal letter of motivation that demonstrates the applicant' s abilities, the skills sought, the ideal attitude to have during its job interview, and even the head of the job. Beyond all these criteria, the time that you will put in finding your job must also be determined by an essential criterion: the sector of activity.

The law of supply and demand. This famous law which explains the functioning of a market economy is also applicable in the labour market. In commercial terms, this law shows that *«in any market, there is always a price level that eliminates the shortage (or surplus) and balances the quantity offered and the quantity demanded. Such a price level is considered optimal because it maximizes the benefits and minimizes the inconvenience for both sellers and buyers.»*

As far as the job market is concerned, let's say that there are sectors of activity where job seekers outnumber the job offers presented. Communication, marketing or finance are some of these sectors. Furthermore, there are sectors of activity in which the supply of work is definitely higher compared to the demand on the market. The new technologies (STEM - Science, Technology, Engineering & Mathematics) including 3D printing are fortunately or unfortunately part of this category of sectors.

To the delight of those who are passionate about STEM, Joblift, a platform for employment, (active in France, Germany, the United Kingdom, the Netherlands and the United States), recently analyzed jobs around 3D printers in France.

3D printing in France

Over the past 24 months, the labour market growth doubled between 2016 and 2017. In the additive manufacturing market, the leading sectors are industry (+ 15%), telecommunications (+ 37%) or personal services (+ 13%). However, note that despite this significant growth, it is still difficult to fill positions for professionals specialized in additive manufacturing. The lack of skills in this sector can easily be blamed on the fact that additive manufacturing in itself is not yet widespread in universities.

According to statistics from the Joblift platform,

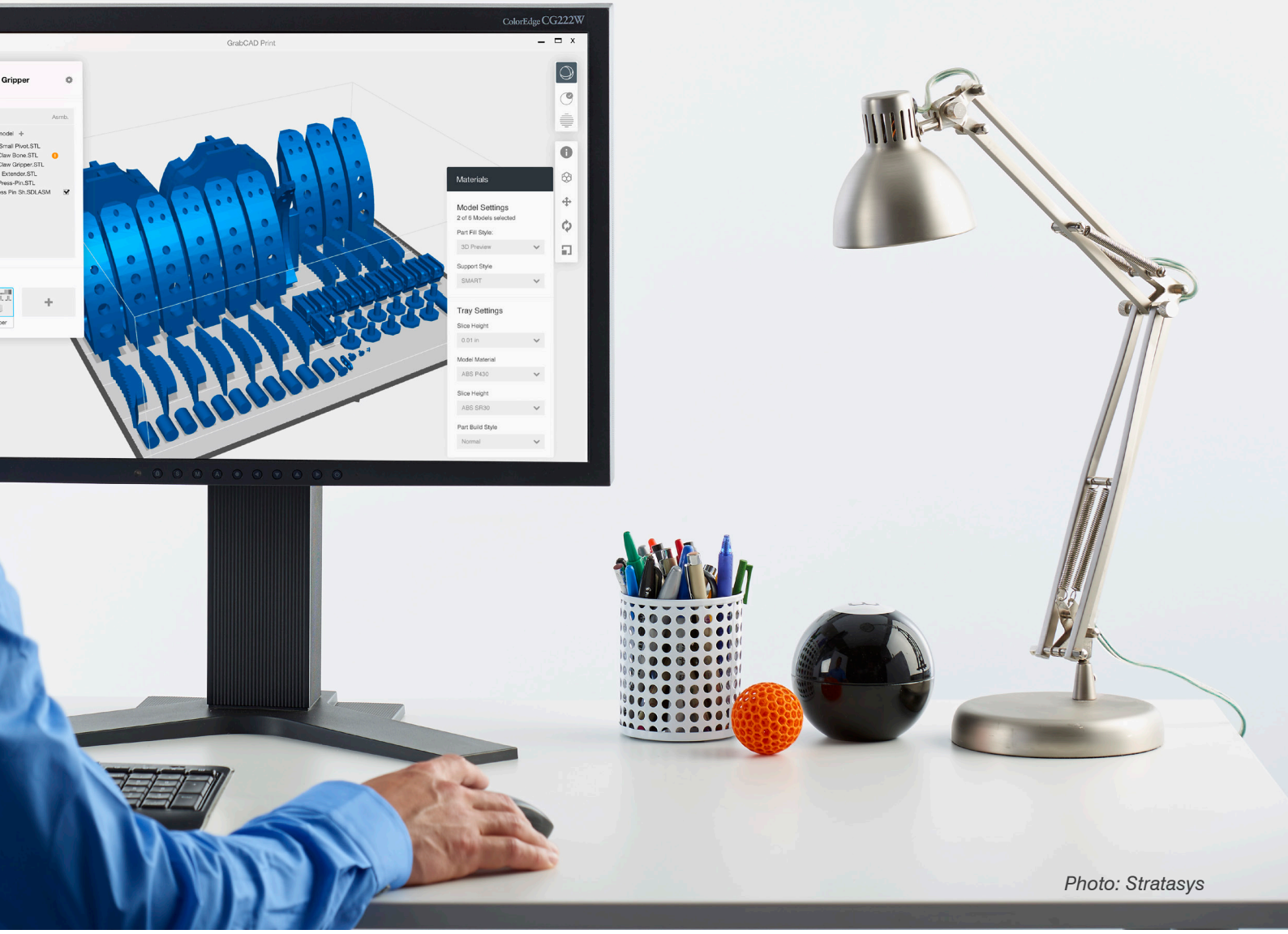


Photo: Stratasys

"5,762 job offers around 3D printers have been published in the last 24 months, which corresponds to an average monthly increase of 12%." These figures reveal that the 3D printing market is growing about 25 times faster than the entire labour market.

Skills vs Recruiting Sectors

Of course, the skills sought must have a logical link with the sectors that recruit the most.

«28% of the offers are for engineers, 17% for mechanical engineers and 10% for developers. 10% of the offers are also dedicated to commercial and 7% to industrial designers. This shows the breadth and diversity of skills required for the development and commercialization of 3D printers." Finally, it should be kept in mind that Joblift has an average of 43 days to fill a position, compared to 39 days in total for the three main sectors concerned (industry, telecommunications and personal services, accounting for 77% of the total number of vacancies). «Four significant days applied to these sectors demonstrate the difficulties companies might encounter to find 3D printing professionals." So, passionate about 3D printing, you know what to do to find the job of your dreams.

INTERVIEW DR. MARTIN MCMAHON

Business Development Manager, Additive Manufacturing Solution Centers at Renishaw: Metal 3D printing in the automotive and aerospace industries as well as Renishaw's solutions in the 3D Printing industry

With a 40-year experience in manufacturing systems, Renishaw has a background that is founded on metrology. The company provides services in applications from jet engine manufacture to brain surgery.
After almost 10 years of steadily increasing adoption of 3D printing technology, there is still a significant potential but also critical points that we should pay attention to; especially in the automotive and aerospace.
Dr. Martin McMahon shares Renishaw's experience in these sectors today, and the areas for increased adoption of metal 3D printing in those two key sectors.

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What is the contribution of 3D printing in the automotive and aerospace areas?

Automotive and aerospace can be broken down to various small sub-sectors.

As far as additive manufacturing (AM) technology is concerned, 3D printing technology has been increasingly adopted over the past 10 years. Plastic printers have been used for prototyping, tooling and more recently they have been used for production of parts for automotive applications.

Similarly, in aerospace, there are many different sub-sectors: civil and defense aircraft including airframes and engines, aerospace applications such as satellites. The marketplace is very complex and applications of 3D printing include plastic parts, components, or even complete assemblies where the technology can contribute to weight saving, reliability or even improved performance.

As for metal 3D printers, they tend to be used for specialist applications; these niche applications will become more viable for metal additive manufacturing as the cost per part and productivity continues to improve.

We are now at the inflection point, where companies that found the technology too expensive a few years ago, are now investing in the technology as it is now more productive and features improved quality control.

What solutions do Renishaw offer companies in these sectors in order to support them in the integration of this technology into their manufacturing process?

Renishaw has a multi-directional approach to helping companies integrate AM into their processes. We have the hardware (machine technology), software and training (technology transfer).

Two or three years ago, we introduced the **RenAM 500M** system. This is a single laser system with a focus on manufacturing, more recently we have added to this platform with the RenAM 500Q, a quad laser system for increased productivity.

This platform helps companies to increase their production through higher build rate. As well as lowering the cost per part, processes are more stable leading to improved production yield. In most sensitive production environments like aerospace, medical, automotive, there is a highly controlled quality environment. Once the manufacturing production process is established, it is very difficult and often undesirable to change something so the RenAM 500Q also has a strong focus on stability and component quality.

The RenAM 500Q machine is designed for one type of alloy at a time. In other terms, if a specific type of alloy has been qualified for the manufacturing process in the aerospace, the machine will use that same alloy for a family of applications. This allowed Renishaw to develop a machine that is very compact, very easy to use, and does not need any additional equipment for the recycling of metal powder.

Other improvements include full digital control with precise positioning feedback on the laser guiding system and increased its productivity by combining up to four lasers, each with a full field of view of the 250mm x 250mm powder bed for maximum laser efficiency.

We have established a user-friendly software suite in addition to this system including:

QuantAM build preparation software is designed specifically for Renishaw AM platforms, allowing tighter integration into the machine control software and the ability to accurately and rapidly review all build files for Renishaw AM systems, including those from third party packages.

InfiniAM Central allows you to monitor multiple machines – to read the state of the machine (how much powder to use, how much materials, the conditions, the quality, the atmosphere, etc.)

InfiniAM Spectral software is designed to process laser feedback which is essential in understanding component quality throughout the build process, monitoring laser and melt-pool characteristics.

Lastly, the technology transfer. We recognize that investment in capital equipment requires careful consideration; one solution we offer allows the customer to come to work directly with our Renishaw Solutions Centres and learn about the technology, understand the design and how it functions, and see how the engineering process flow works to manufacture AM components. The facility provides a secure development environment in which customers can expand their knowledge and confidence using additive manufacturing (AM) technology.

Speaking of a specific example of the metallic additive manufacturing of a part in each sector, what are the advantages and disadvantages compared to traditional manufacturing methods?

Most people are not fully aware of the advantages: these could be classified as part performance improvements, such as the production of complex geometries, light-weighting for efficiency and consolidation of multiple parts to improve reliability. Part consolidation can also bring operational benefits and reduced inventory, as do reduction in tooling and the benefits of rapid design iterations helping bring product to market faster.

It's about making parts innovatively and improving functionality. Applied properly, metal additive manufacturing allows the user to make parts which are not viable in subtractive methods.

The main challenge is that AM is a relatively new technology, engineers are not fully intuitively using its full capabilities, so if you are completing a like for like comparison with manufacturing costs, it may on the surface appear uncompetitive compared to traditional methods.

For maximum success AM is best applied alongside traditional technologies where the advantages of each are applied effectively. When you start to consider capital investment in tooling, design limitations in product performance and design life cycles, the benefits can become more compelling.

Renishaw Solutions Centres are a way for new users to experience AM and help lower the entry barrier by providing cost-effective access to machinery, facilities and AM expertise. Solutions Centres will provide a confidential development environment in which firms can explore the benefits that AM can bring to their products, and quickly build their knowledge and confidence in AM as a production technology.

What would be the limitations observed in each sector in terms of materials?

Most people ask themselves: *"How does the AM material compare to a conventionally cast material?"* You can make these comparisons but you can never make them the same. Engineers are used to designing whilst taking into account the properties of materials for conventional techniques. However, the key relies on understanding the limits and the properties of the materials when it comes to additive manufacturing. Engineers need to understand the differences in the material properties.

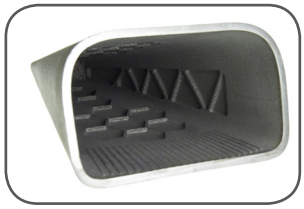
However, over time there is a great number of research programs that have been carried out to understand these properties and to enable people to use AM components. In most cases, materials produced using a properly maintained and run metal AM system are comparable to conventionally produced materials. **Not all materials can be processed, with high carbon steels and other difficult to weld materials proving more challenging**. Here Renishaw is developing higher temperature processing conditions to try and overcome this limitation. Only by understanding how the materials perform, can corporations position themselves to adopt AM into production.

How do you perceive the metal additive manufacturing market in the long run?

Additive manufacturing is continuously growing in acceptance; however, the reality is that the additive manufacturing is a complementary technology to conventional techniques (casting, machining, etc.).

AM allows people to make the initial product run by making sure the design is fully correct. Even if we eliminate the assembly of components, and we use AM to make cheaper parts or multiple parts into one, you still need to do some machining. There will always be some requirements to do some machining.

I see a future where people will know it is just one tool in a very large toolbox of possible manufacturing techniques.



3D Printers & Materials

3D Printing

New

Zoom on popular materials in the automotive and aerospace industries

New

Will the mass public succumb to temptation?

New

Ultimaker S5 : the satisfaction of manufacturers vs the fear of makers

ZOOM ON POPULAR MATERIALS IN THE AUTOMOTIVE AND AEROSPACE INDUSTRIES

In the April issue of 3D Adept Mag, we talked a lot about the capabilities of carbon fiber and its applications in the industrial sector. However, there is a real challenge for companies to offer materials that are truly appropriate for the automotive and aeronautics sectors. The choice of materials is even more important since industrials must respect certain conditions during the production.

In a podcast published by the National Office for Studies and Aerospace Research (Onera) – which is also active today in the automotive sector - Jean-François Maire, director of the materials and composite structures department at the centre explains that greenhouse gases represent one of the biggest challenges of the automotive industry. In order to reduce their emission, manufacturers must absolutely lower the weight of vehicles hence the increasing use of very light materials, which are difficult to handle.

These new created materials are called composite materials. They are made up of two or more components whose properties complement each other and form a new material that improves "the quality of the material for a certain use (lightness, rigidity with an effort, etc.)".

Moreover, the particularity of the aerospace sector is that it is subjected to extremely high temperature conditions, hence the use of materials that have a strong resistance in such type of environment.

THE SPECIFICATIONS OF THE MANUFACTURERS

Beyond this requirement regarding the manufacturing conditions of parts, it is also a strategic choice for companies to provide the market with unique products.

TREED AND ITS UNIQUE SOLUTION FOR THE AUTOMOTIVE MARKET

TreeD Filaments, Italian manufacturer of materials, officially unveiled this month **PNEUMATIQUE**. This material is derived from recycled rubber tires and offers similar qualities to the original material in terms of strength and flexibility.

The manufacturer is transforming an ecological problem into a useful solution for the industry.

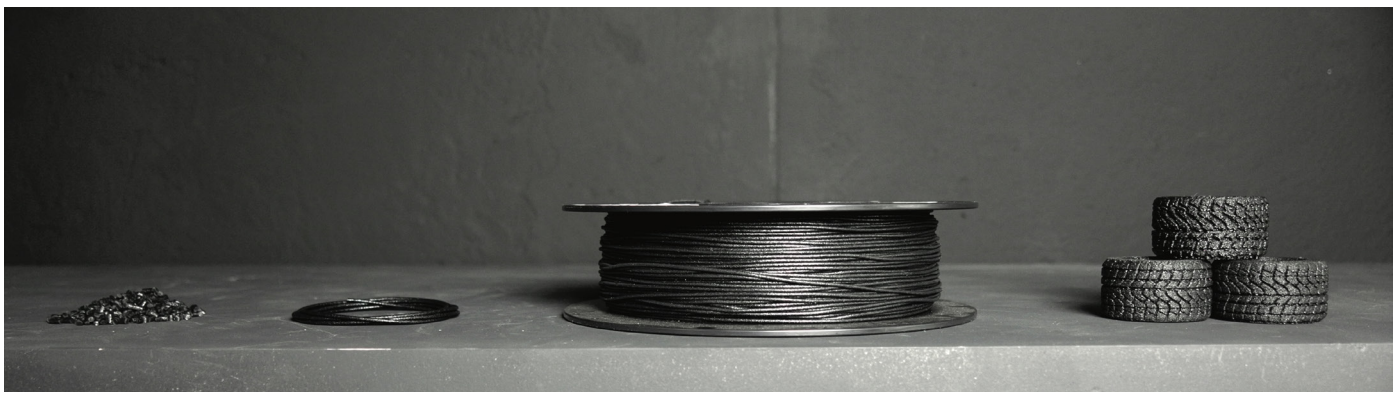
Rubber tires are a significant source of waste on the planet and have caused significant ecological challenges in terms of disposal. It is only in recent decades that waste tires have been made recyclable, and they've been put towards a range of applications, from asphalt manufacturing and eco-friendly construction to fuel production. TreeD brings its contribution to this dynamic with the help of **Tire Recycling Solutions** (TRS).

The material uniquely provides elasticity, durability and resistance. The filament, meanwhile, aims to improve the recycled rubber's performance by optimizing wear-resistance and improving elastic memory.

From a technical point of view, the PNEUMATIQUE filament boasts a Shore A hardness of 80, exceptional layer adhesion properties and good abrasion-resistance. The filament's matte finish and deep black-gray color, along with its slightly rough (anti-grip) texture are reminiscent of actual rubber tires.

When printing, TreeD recommends using a print temperature between 190 and 230 ° C and a print speed of 20 to 40 mm / s. Manufacturers may notice the distinct smell of rubber during the printing process. When the printing is complete, TreeD also suggests to use a cleaning filament to clean the extruder from the printer.

It is now possible to print recycled rubber objects.



THE CASE OF BASF AND ESSENTIUM MATERIALS

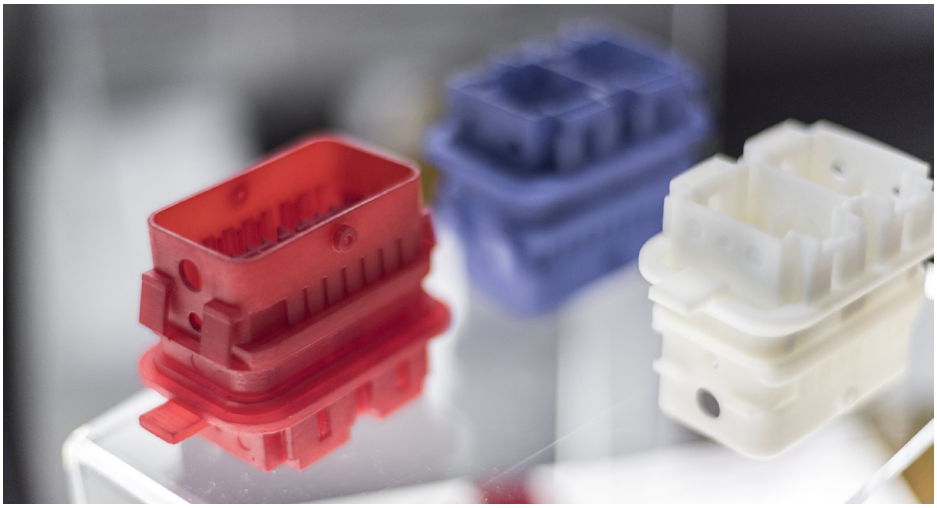
Both companies are very committed to implementing a plastic filament distribution network. They collect a significant portion of their industrial filament materials under the name **Ultrafuse**.

The Ultrafuse series is dedicated to industrial applications and will help customers who are always looking for the ideal material for **FFF technology**.

Technically speaking, the products include « Ultrafuse Z, a special, extra strong filament based on BASF materials, further developed by Essentium, and offered in combination with Essentium Materials' processing technology, FlashFuseTM." Consequently, customers will be able to print components with optimum strength in the z-direction.

For SLS technology, both companies offer: **Ultrasint PA6 LM X085**. This polyamide-6 gray powder melts at about 193 degrees Celsius. "These properties allow us to offer a PA6-based material to customers, especially those in the automotive and consumer goods industries, where today there is mainly only a choice between different PA11 and PA12 types," explains **Alexander Cochrane**, Marketing Manager 3D-Printing Powder Bed Fusion. *"The first parts produced with new Ultrasint PA6 LM are convincing, so we expect to be able to supply our first customers with our powder material in late summer,"* says **Cochrane**.

As for other technologies, the recently launched X004M photo-resin has been specially optimized for stereolithography (SLA), digital light processing (DLP) and LCD printers. The material offers high tensile strength and high modulus of elasticity. For both technologies, the light source is placed under the printing material.



Resin X004M

ANTERO 800NA, STRATASYS THERMOPLASTIC FOR PEKK-BASED FDM PROCESS

Antero 800NA is one of the materials that aeronautical equipment manufacturers and other vehicles can use when it comes to making additive parts exposed to chemicals and high temperatures.

Used with FDM technology, the Antero 800NA is known for its chemical resistance and ultra-low degassing. It also offers properties similar to those of carbon. Indeed, its characteristics are exploitable in high temperatures, and it also resists very well to wear.

"Its superior chemical resistance means it can be used for components exposed to hydrocarbons, such as fuels and lubricants, as well as many acids. Additionally, its low outgassing allows it to be used in confined spaces and sensitive environments, such as satellites, where materials may not outgas under vacuum. Antero 800NA's high operating temperature is designed to allow it to be used for applications under the hood or in engine compartments"

A SPECIFIC TYPE OF ADDITIVE MANUFACTURING (FA)

Custom additive or low volume manufacturing is ideal for the Antero 800NA. In addition to the cost savings observed here, in traditional processes such as machining, manufacturers purchase PEKK in bulk (only available in limited shapes and sizes) and machine it until they get a clean form. This results in a waste of expensive material and a longer delivery time.

With 3D printing, however, the workflow is faster, resulting in lighter parts with optimized topology and reduced waste.

As for the PEKK parts that have been additively manufactured on demand, there is a clear reduction of inventory costs and increased profitability.

"Antero 800NA is the first commercial product in a planned new family of PEKK-based materials. The material will be offered with an initial layer thickness of 0.010 in (0.25mm) and additional layer-thickness options planned for future release."

This material will be used to predominantly make 100 3D printed parts during the mission of **Orion Exploration Mission-2 (EM-2)**. (Orion is the NASA spacecraft that will send astronauts to the Moon and beyond.)

During the production, the team will use materials such as ULTEM 9085 ™ resin and Antero material that offer **electro-static dissipative** (ESD) functionality.

High-end industrial manufacturing, as well as oil and gas applications, are other areas of potential applications in addition to automotive and aerospace.

OMNI3D AND ITS ADDED CARBON FIBER FILAMENT (CF-PA-12)

We cannot end without talking about carbon fiber. CF-PA-12 is a high strength material recommended for low shrinkage and stiffness.

Speaking of the material, Krzysztof Kardach, 3D printing technologist, responsible for testing and introducing filaments at OMNI3D, said *«CF-PA-12 is a polyamide 12 (PA 12) based composite, reinforced with carbon fibers. It has exceptional durability as well as high stiffness and tensile strength. The last feature is especially worth noting, because carbon fiber has over 2.5 times more strength than the popular ABS-42.»*

As a reminder, carbon fiber can be combined with other materials to print 3D sacrificial tools for components and composite parts.

The low shrinkage of the material and its high thermal resistance mean that the tools made with carbon fiber can operate up to 160 ° C. In addition, according to **Krzysztof Kardach**, the resistance to ABS can be evaluated twice as low because prints of this material can be used up to about 87 ° C.

Carbon fiber also incorporates high chemical resistance. *"CF-PA-12 retains the structural stiffness of the carbon fiber regardless of the ambient humidity. It is lightweight, with an elegant, semi-matte finish."*

The material can be used to produce parts of cars and drones, as well as components that require high durability and light weight. In addition, it could operate in a demanding environment, and in some cases, it can replace items previously made from metal.

«It is excellent in component engineering, for producing final components and functional prototypes and testing structural elements or devices and instrumentation,» adds **Krzysztof Kardach**.

The company will release more materials for specific applications in the coming months. The manufacturer's flagship 3D printer, Factory 2.0, has automatic print settings that specify the settings for all compatible filaments.

3D METAL PRINTERS THE USER'S FAVORITES

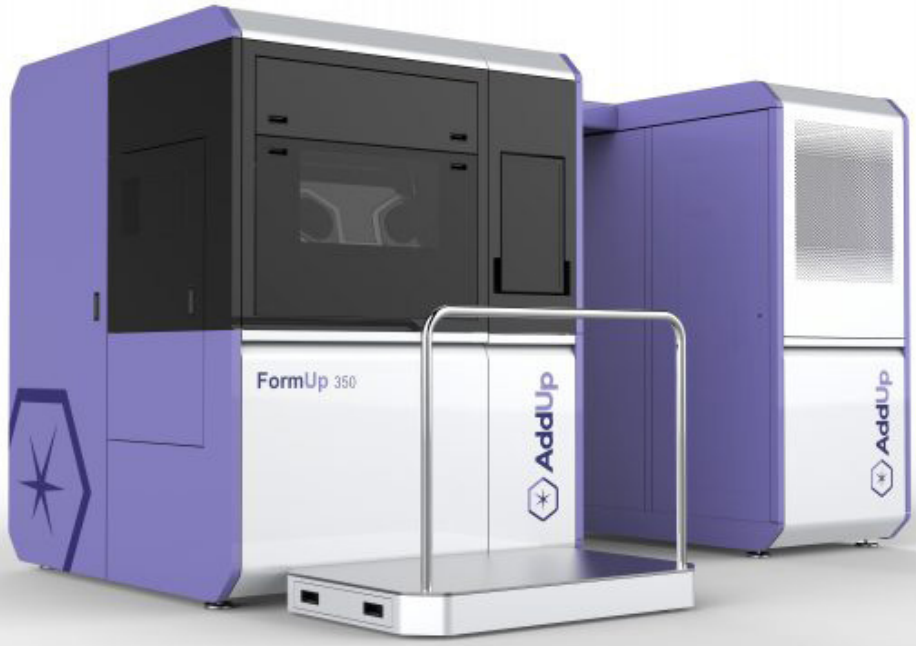
If you are a 3D printing professional, you have probably noticed that 3D metal printing arouses a craze among manufacturers. Some have made it their core business, perhaps because 3D printed parts can easily be customized for the mass audience or because this manufacturing technique is focusing on how to have zero waste ... There are many reasons ... there are also many 3D metal printers, but very few stand out in the market.

First and foremost, it would be difficult (and a bit boring) to enumerate the list of metal 3D printers on the market. We focused on the 3D printers that are the most used in Europe and that some professionals prefer because of the solutions they offer. There are three types of metal 3D printers:

3D metal printers that integrate a power bed fusion technology

In this category, 3D printers from 3D Systems are frequently used. Incorporating Direct Metal Printing (DMP) technology, the manufacturer's metal systems have a high-precision laser that solidifies the powder. The ProX DMP 200 and ProX DMP 300 systems fit into this range.

Among the printers that use this technology, there is also the FormUp 350 AddUp. With a volume of 350x350x350 mm, it is the first system of the joint venture of Michelin and the Fives group.



FormUp 3D printer that integrates the powder bed fusion process

It is almost impossible to talk about 3D metal printing without talking about Desktop Metal. The Studio System is the flagship product of the American manufacturer.

With a process called Bound Metal Deposition (BMD), the use of this printer will make you think of FDM technology, but it actually uses MIM metal powders bonded to each other by a mixture of polymers.

After additive manufacturing, it is recommended to place the object in the Desktop Metal oven at a temperature that would go up to 1400 degrees Celsius to melt the polymer and obtain the metal part.

Studio System – Flagship product of Desktop Metal

For your information, the Studio System is available in Europe via the 16 distributor partners of the manufacturer including **LaserLines, Tritech 3D, Alphacam or CADvision.**

Apart from the Studio System, Desktop Metal also offers the «Production System». With its 32,000 jets, the 3D printer can eject millions of droplets per second. Be careful, this technology does not integrate the powder bed fusion technology!

It is also difficult to mention Studio System without mentioning **Metal X** among the most popular metal 3D printers of the moment because from a technical perspective, the two 3D printers are not alike. We will not mention the details of the patent infringement lawsuit that ties the two manufacturers.

The **Markforged** 3D printer has a print volume of 250 x 220 x 200 mm and a layer thickness of 50 microns. Like the Studio System, it prints metal powders bound by a mixture of polymers.

Metal X de Markforged – 3D prints metal powder bound in a plastic matrix while enabling new features like closed-cell infill for reduced part weight and cost

Electron Beam Melting Technology (EBM)

Arcam, a company from GE Additive, specializes in this type of metal additive manufacturing. Arcam offers 3D electron beam printing through the Arcam 2X model. With a print volume of 200 x 200 x 380 mm, this 3D printer weighs 1,700 kg. Specially made for aerospace, it offers both solid and light parts. Arcam is the only company, up-to-date, to offer this type of technology on the market.

3D printing system Arcam 2X integrating the Electron Beam Melting technology

Powder projection fusion technology

The **DM 3D printer P2500** from the Swedish manufacturer Digital Metal stands out from the others in the same range thanks to the binder projection method. Designed for the manufacture of small metal parts, the components manufactured with this machine are printed and sintered instead of being fused with lasers, providing superior resolution and detail accuracy.

It is possible to produce both small and complex components with this printer. With a printing volume of 2500 cm3, this machine prints with layers of 42 μm to 100 cm3 / h. This production speed is significantly higher than other 3D printing technologies. In addition to this fact, no need for support structures here.

For the first time this year at Rapid TCT +, the 3D printer was introduced. On European soil, the manufacturer continues its progression on the market with the support of CETIM (Technical Center of Mechanical Industries).

Renishaw, EOS, SLM Solutions, Concept Laser and Trumpf are among the most visible manufacturers on the European market, which also offer a range of quality 3D metal printers.

DM P2500 of Digital Metal

Ultimaker S5 : the satisfaction of manufacturers vs the fear of makers

Ultimaker, the famous Dutch manufacturer of 3D FDM printers has publicised its latest printer: Ultimaker S5, a news that has sparked a hype and a debriefing among makers ...

Over the years, Ultimaker has demonstrated an ability to captivate through its FDM 3D printers solutions: Ultimaker 2+, Ultimaker 3 ... and today the Ultimaker S5.

With the Ultimaker 3, professionals have better understood and managed the production processes and the development of concepts. The Ultimaker S5 has been manufactured based on the Ultimaker 3 and goes beyond the capabilities of this 3D printer.

Ultimaker S5 : its features

In general, the 3D printer offers a large construction volume of 330x240x300 mm, simplified operation and good reliability. So, the Ultimaker S5 can produce prints that are larger than what other printers from the manufacturer can offer.

In addition to an integrated hardware and software configuration, the 3D printer also incorporates a good alignment of parameters. Like most 3D printers, we also have a touch screen and double extrusion on the Ultimaker S5. In addition, the power system has been improved with a filament flow sensor that stops automatically. Also, upgrading the bed allows for a successful first coat and subsequently, unattended use when printing.

The Ultimaker S5 includes a closed front system, and from fall 2018, a coated construction panel.

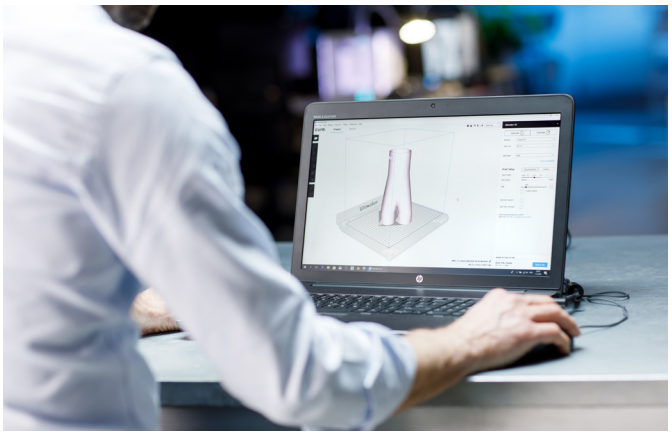
The materials

The manufacturer goes further with its latest printer as professionals have the opportunity to choose a wider range of industrial grade material: from PLA to plastics such as nylon and PC.

Note that the new Ultimaker material supplied with the Ultimaker S5, the «Tough PLA» would have, according to the manufacturer, good impact resistance and high rigidity. It is a material that has mechanical properties similar to ABS, hence its use to make prototypes, tools and/or functional parts.

Applications and software

In addition to the Tough PLA, another highlight of this announcement is the new Ultimaker app that allows users to track the progress of their print from a phone or tablet. You will no longer have to stick to your printer to check the progress of the print.



With this application, Ultimaker relies on the quality of its machine and wants to reassure users. Professionals will recognize that there is always this fear when buying a printer that everything does not go as planned, and indeed, a desire to control the print from the beginning to the end ... In any case, it is a fear that may not exist with the Ultimaker S5 because this application will signal the user when the print job is complete or if the printer needs some attention.

In addition to the Ultimaker S5, users of the Ultimaker 3 will also enjoy the benefits of this application.

In terms of software, those familiar with Ultimaker Cura will continue to use it to prepare their prints and send them wirelessly to the printer.

The user's point of view

First of all, it should be noted that Ultimaker 3D printers are very popular among makers and professionals in general.

However, with the entry of the Ultimaker S5 on the market, it is observed that the Dutch manufacturer is **gradually moving towards the path of industrialization and attracts more and more companies in this sector.** Since the release of this 3D printer, many manufacturers who already knew and integrated the capabilities of the manufacturer's printers, have already been conquered by the capabilities of this S5. This is the case of **Zeiss, Renault, Ford** and even **Volkswagen**.

At **Renault**, we can also hear **Rodrigue Dimitri**, 3D Print Driver, testify: *« the fact that the Ultimaker S5 is even more intuitive and delivers a perfect first layer for every print means we spend hardly any time setting up and checking on the 3D printers. This frees up our team more time to fully focus on the creation of new innovations that help to improve and speed up our engine manufacturing process.»*

One thing is certain, the potential of Ultimaker's 3D technology is not in question; it's quite the opposite. However, with the strong brand image that Ultimaker brings forth today and its growing place in the industry, the maker simply realizes that the manufacturer of FDM 3D printers does no longer simply address to «Mr. Everyone» and wonders if it is wise to invest in an S5 (which costs 5495 €) if he/she already has its Ultimaker 3.

Tubes imprimés avec Ultimaker Tough PLA

Glowforge & M3D:

Will the mass public succumb to temptation?

Glowforge and M3D are both 3D printer manufacturers. The first is specialized in 3D laser printers and the second is a specialist of the micro 3D printer. However, they have two things in common: they are both American manufacturers that primarily target professionals within the mass market.

Glowforge and M3D recently unveiled a new product. Glowforge finally released its 3D laser printer while M3D unveiled the Crane Quad 3D printer. On characteristic level, these 3D printers have practically nothing in common but each of them presents in its own way, points that will perhaps make professionals succumb to the temptation.

Glowforge: the 3D printer laser

The story of Glowforge begins in 2015. The company has made history (and especially left users speechless) by breaking the 30-day crowdfunding record that has never been held to date. The campaign that featured the laser 3D printer allowed Glowforge to raise more than $27,900,000 USD.

Preorders are now complete and Glowforge has officially announced its

release to the mass public.

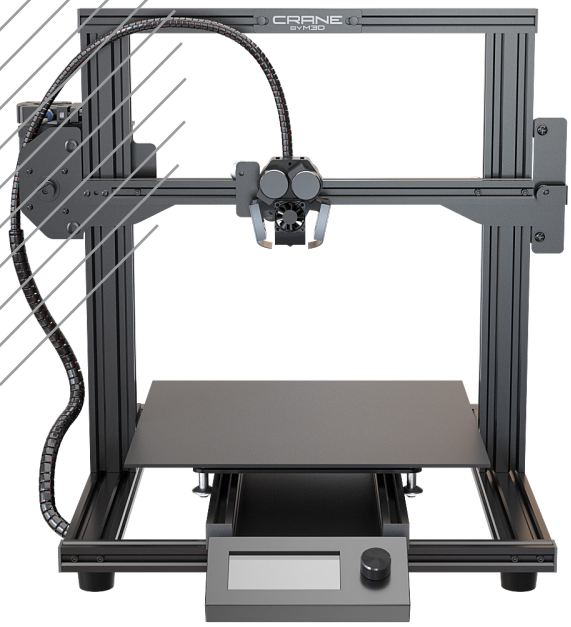
The manufacturer has made its machine easy to use for individuals and small businesses.

Specifically, the Glowforge requires just a few minutes of installation and works via Wi-Fi. No software is required, because the machine uses the web browser or application on any Mac, PC, tablet and smartphone. «Users can create and print from software including Adobe Illustrator, Inkscape, CorelDraw, Adobe Photoshop, GIMP, Autodesk 360, and Sketchup. They can also bypass software altogether – the onboard cameras can scan a drawing and transform it directly into a beautiful print on almost any material.»

In terms of materials, users can print on a wide range of materials: leather, wood, acrylic, paper, fabric, cardboard, metal, glass, ceramic, stone, laptops and even chocolate. Isn't it amazing that a 3D printer can present so many choices?

Users can also print with the manufacturer's Proofgrade ™ line of materials. Launched in early 2018, these materials are formulated for the Glowforge laser 3D printer and work well with other cutters / recorders using CO2 laser technology. These are digitally encoded so that Glowforge printers can recognize and adjust them automatically when printing. There are many creative possibilities: from custom leather necklaces to coffee makers to outdoor business brands ...

What makes Glowforge unique is the range of materials that can be used with the laser 3D printer whereas M3D distinguishes itself from other 3D printers of the same range through its wide range of colors.



M3D and its 3D color printer

What makes Glowforge unique is the range of materials that can be used with the laser 3D printer whereas M3D distinguishes itself from other 3D printers of the same range through its wide range of colors.

Crane Quad is a multi-material desktop 3D printer capable of producing multicolored objects.

For the record, the company realized that 3D FDM printers are often limited to extruding with one material at a time, which involves complex hardware modifications or to guide different materials between layers to get some colors in the printing.

The Crane Quad 3D printer solves this problem with more than 50,000 colors. It can mix up to four standard 1.75 mm filament colors. «The base colors needed are CMYK: cyan, magenta and yellow with black, white or transparent as keys. In addition, Crane Quad allows users to print objects in any single color without the cost of owning dozens of traditional filament spools and allows the physical characteristics of different materials to be fused into a single object with new properties. «

Technically speaking, the 3D printer incorporates a brand-new 3D print head, QuadFusionTM, which allows it to print and mix four filament colors. This direct drive extruder can mix the two colors and the material type of most 1.75 mm filaments. The head is equipped with four motors, three fans and a 0.35 mm mixing nozzle. The printer finally has a construction volume of 214 x 214 x 230 mm.

A uniquely “interesting” price

Each of these 3D printers has unique features that are sought after by professionals. The same target can use the technologies of both manufacturers.

However, each manufacturer in their product category presents a technology at an affordable price.

In fact, for a multi-material and multi-color FDM 3D printer priced at a minimum of $399, M3D challenges multi-color 3D printers such as the XYZ Prining da Vinci Color that have already conquered the market.

As for Glowforge, its success lies in the fact that industrial laser cutting / engraving technology has always been too expensive and complicated for consumers; complication which is due to the choice of materials.

Glowforge remedies this with a basic offer ($ 2,495) for home, recreation and crafts; an extra offer ($ 3,995) that features a more powerful laser to print up to 20% faster, in addition to a double warranty and a Pro offer ($ 5,995) for home-based entrepreneurs and small enterprises. The Pro can be used all day and allows the printing of large projects including decoration and furniture.

And you, would you let yourself be tempted by one of these printers?

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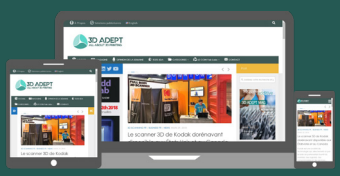

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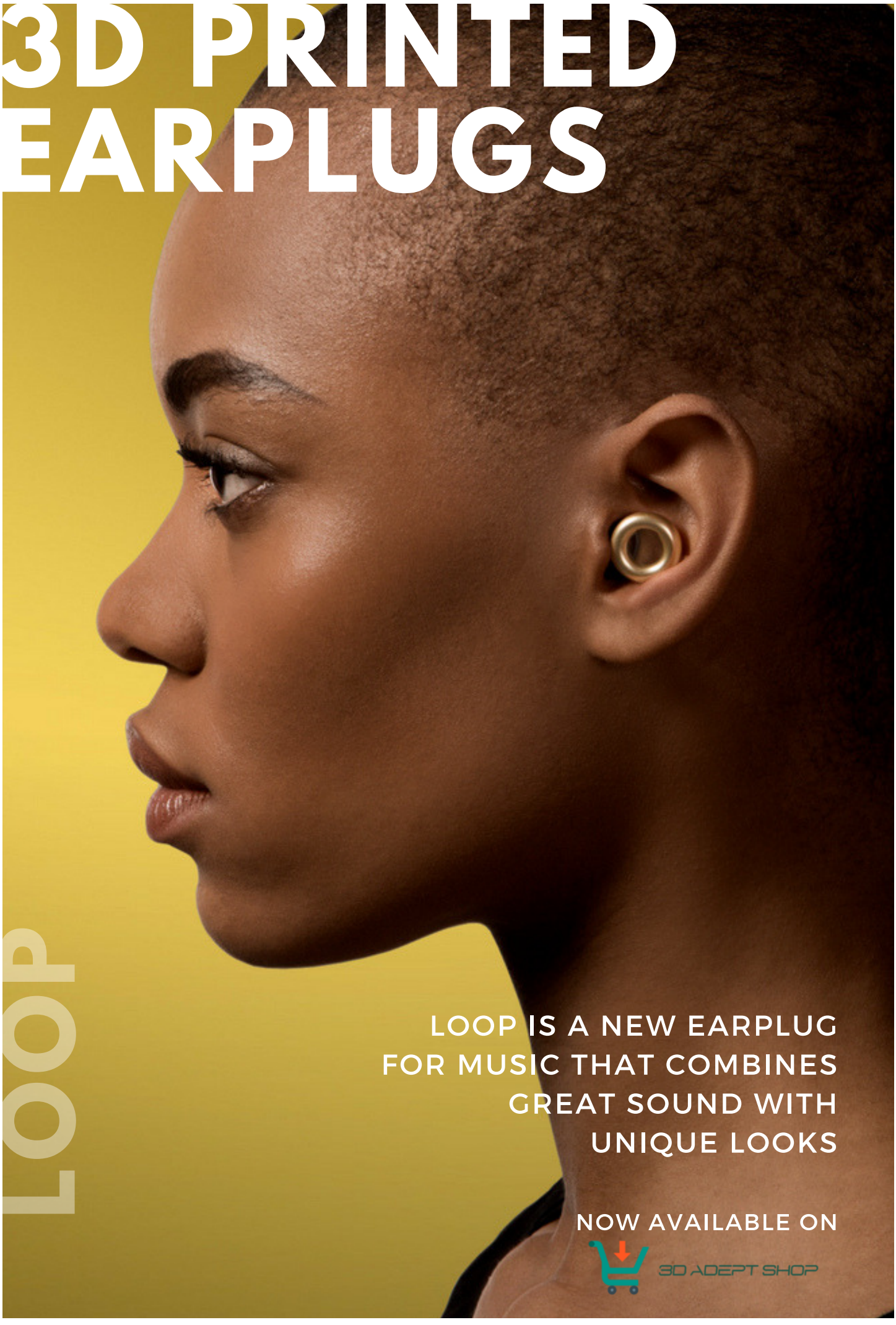

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