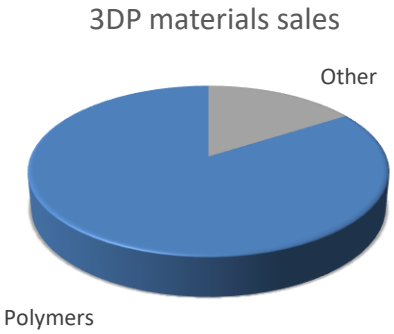
EuPC Vision Paper

Towards 3D Printing within the Plastics Converting Industry in Europe

Read how 3D printing will shape the future of the plastics converting industry.

3D printing (**3DP**) or additive manufacturing (**AM**) has been available on the market since the beginning of the 1980's. Despite the fact that the 3DP industry has experienced significant growth almost since the beginning – **the compound annual growth rate of worldwide revenues for the last 28 years is 25,9%** – it has only gotten global attention in recent years. In 2016, the worldwide **revenues of the 3DP industry grew to 6,1 billion $**.[1]

3DP can be done with a vast number of different materials (plastics, metals, stone-like materials, food, glass, tissue, etc.), but **plastics are by far the most important material in the 3DP industry**: In 2016, over 84% of sold 3DP materials were polymers.[2]



This formed the ground for EuPC to set up a 3DP platform in order to define a European vision and stand point for its members regarding this new technology. **3DP offers huge possibilities and should be embraced as an opportunity to grow the business of plastics converters in Europe.**

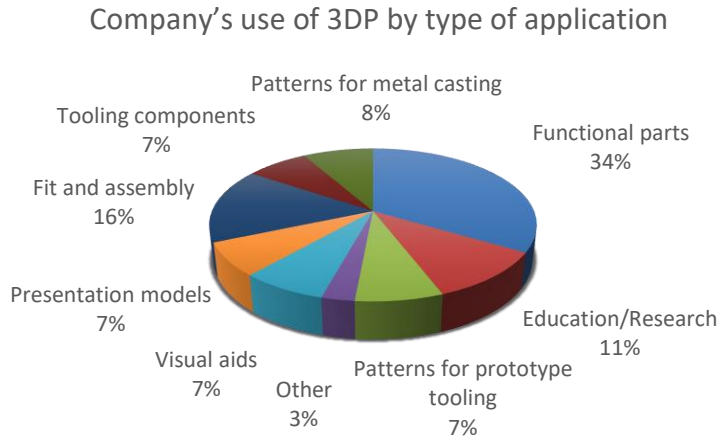
Application areas

Contrary to injection moulding, thermal forming, blow moulding, extrusion or rubber pressing, **3DP is a mould-less technology**. Therefore it is ultimately suitable for single product manufacturing or small series production. Bearing this in mind, the following general focus areas can be identified:

1. Medical technology (personalised Implants, 'practice organs' for surgeons training, single use operation aids, treatment fixtures, etc.)
2. Maintenance and repair of machines and installations (out of stock parts, spare parts, end of life parts, printing on location for temporarily solutions, etc.)
3. Personalised items (consumer applications like jewellery, smart phone covers, etc.)
4. Industrial fixtures and attachments for machines and installations (robot arm grippers, glue fixtures flow guiders, etc.)

In applications where small products are involved (like led caps), **3DP already provides opportunities for large volume productions**.

[1] Industry figures taken from the Wohlers Report 2017, p.148.
[2] Wohlers Report 2017, p.159.



Currently, **companies are using 3DP to produce functional parts more than anything else**. On the second place follow prototypes for fit and assembly, before education and research, and patterns for metal casting as well as prototype tooling.[1]

The relation of 3DP printing to existing converting technologies in the plastics industry

3D printing is a manufacturing process, where an artefact is built by adding material layer-wise. The focus and attention towards this development are lying on process on one side and applicable materials on the other side. **In most commercial available 3DP processes, the mechanism is a x-y-z movement of printing heads and/or support table**. As a consequence of these intrinsic mechanical components, these movements are limited in speed and sensitive to disturbances. In all existing systems, the resolution in the Z- (vertical) axis is determined by the layer thickness, which influences the building speed.

In theory, every product that can be made by injection moulding, blow moulding, extrusion or thermal forming could be 3D printed. The relevant questions to assess the use of 3DP are:

1. Can 3DP offer advantages in comparison to other converting processes, e.g. improve the functionality of the part or faster/cheaper production?
2. Are the functional properties identical or at least acceptable for the application?
3. Are the aesthetical properties identical or at least acceptable for the application?
4. Is it economically feasible?
5. Is it logistically feasible?

These questions cannot be answered generically, but **need to be addressed case by case**. Additionally, it needs to be taken into account that cases which are not feasible at a certain moment in time, can be feasible later due to the ongoing developments and increasing possibilities. The growth and implementation of 3DP cannot be denied and it's impossible to predict where it stops.

At this moment, 3DP technology should not be seen as a threat to (the majority of) plastics converters. In some specific areas, there will be some substitutions but in series production of substantial volumes there is still low economic feasibility. 3DP generally provides chances to cover the gap between single part production and high volume production. However, the developments go very fast and it seems important to stay closely connected to the early adopters of the technology.

EuPC and 3D Printing

To embrace 3DP and the opportunities it brings for the plastics converting industry, EuPC initiated a series of actions. The 3DP Platform was launched during EuPC's General Assembly in June and started its work in July, when the first meeting of the 3DP Working Group took place in Brussels. **The platform is open to all companies, associations and organisations who have an interest in 3DP and the plastics converting industry**.

EUPC AND 3D PRINTING

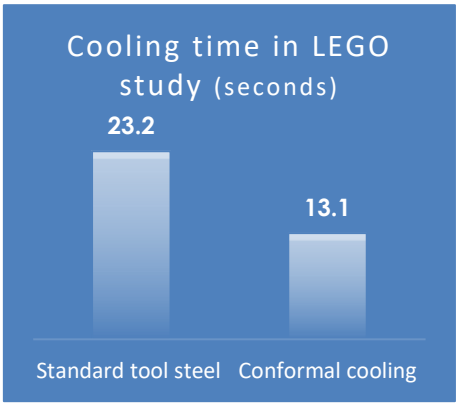
- 3DP Platform created at EuPC's General Assembly in June 2017.
- First meeting of 3DP Working Group in July 2017.
- 3DP Vision Paper to stimulate discussion and raise awareness.
- Survey on the status of 3DP in the plastics converting industry.

The first step to enable plastics converters to use the full potential of the 3DP industry, is to inform converting companies, which opportunities 3DP bears for their business. To raise awareness and stimulate the consideration of 3DP, EuPC drafted this note and a **survey designed to provide a better view of the current status of 3DP in the plastics converting industry**.

3DP Polymers are used in a wide array of applications, from the production of personalised items and industrial fixtures, over the maintenance and repair of machines and installations, to medical technology. **The 3DP of plastic objects clearly has a direct impact on the plastics converting industry, but 3DP affects plastics converting on more levels**.

3DP advantages and current uses

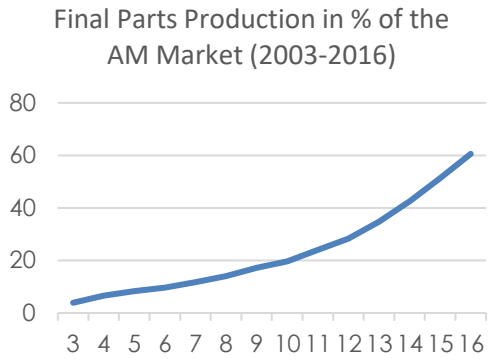
3DP metal moulds for example offer new ways to cool parts through the use of conformal cooling channels, which can reduce cycle time significantly. The Swedish toy company LEGO tested **3DP moulds** with conformal cooling in 2010 and **was able to reduce cycle time by almost 50%**.[3] Additionally, 3DP moulds can enable plastics converters to manufacture individualised parts and speed up time to market, as they can be manufactured cheaper and quicker than usual moulds when it comes to smaller series.



Currently, 3DP is mostly used for prototyping and single parts production, but **its advantages make 3DP as well attractive for larger series production**, as some shapes simply cannot be manufactured with other production processes. In applications where small products are involved (like led caps), 3D printing already provides opportunities for large volume productions. Other advantages of 3DP are the reduction of tooling, agile manufacturing operations, decentralised manufacturing, inventory reduction and part consolidation, weight reduction, design freedom, fewer manufacturing steps, and better time to market.

[3] https://plasticsengineeringblog.com

A widespread reservation about 3DP is the belief, that it is not suited for final parts production, due to the material properties of 3DP parts or poor surface finishing. Development and improvements in 3DP processes are however progressing fast, and **the production of final parts using 3DP is growing rapidly**: In 2016, final parts production made up over 60% of the 3DP market.[4]



The biggest barrier to the use of 3DP in the plastics converting industry probably are the high costs of machines and materials, but this is presumed to change soon. The fast growth of the 3DP industry is expected to continue – the leading industry report, 'Wohlers', expects the industry to grow by 4.3 times by 2022[5] – and **the rise of the economies of scale effect will make 3DP applications cheaper**. The same applies for 3DP materials, especially as global companies as Covestro and BASF have started to develop 3DP materials.

The benefits of 3DP are accessible for all plastic converting companies. Possible cooperations with service providers limit the need of expensive purchases and offer a wide array of different forms of collaboration. Training courses are provided for companies who wish to increase their 3DP know-how and education about 3DP will generally get stronger. While the design of 3DP parts requires a radically different approach than more traditional manufacturing methods, the operation of most 3DP machines does not require such extensive knowledge.

3DP offers many advantages for plastics converters, who are willing to incorporate the technology in their production process. Prototyping is already well established and new applications emerge fast. Moulds with conformal cooling can reduce cycle time significantly, and individual moulds for smaller series can be manufactured faster and cheaper with 3DP. Even the production of final parts is growing, and will continue to grow, thanks to continuous improvements of 3DP processes.

More information on EuPC's 3DP platform can be found on EuPC's website. For additional information please contact Felix Miessen at felix.miessen@eupc.org.

[4] Wohlers Report 2017, p.176.
[5] Wohlers Report 2017, p.297.