Press review
Pollen AM

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TPE in 3D printing: Pollen AM overcomes hardness limits

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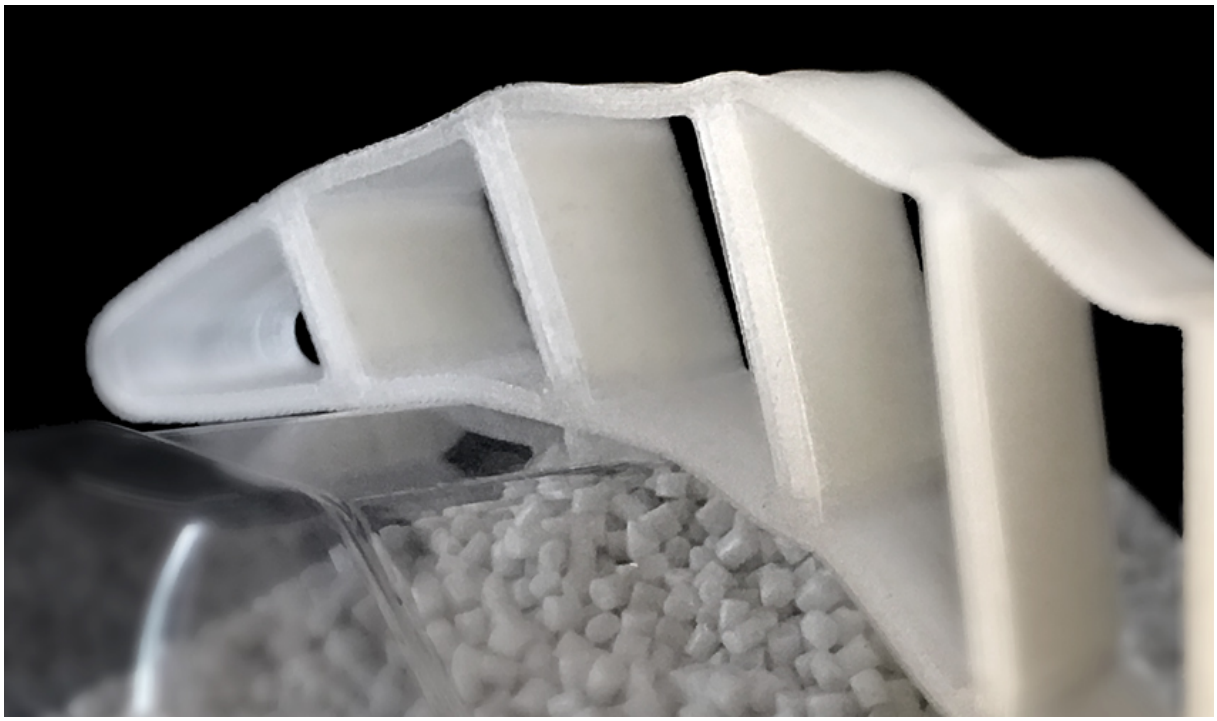


The French manufacturer Pollen AM offers additive manufacturing technology which today allows the widest range of thermoplastic elastomers (TPE) to be printed on the market, whatever their hardness. By extruding the material in the form of industrial granules, the company overcomes certain constraints specific to the filaments and can create parts without hardness limit. A process that has many advantages for several sectors of activity, notably the automobile or sports equipment. But what exactly are these advantages and what chemical and mechanical properties does the TPE family offer when it comes to 3D printing?

Founded in 2013, the company Pollen AM has caused a lot of ink to flow on the 3D printing market thanks to its Pam Series P machine: equipped with 4 retractable extruders, autonomous and independent, it is compatible with the thermoplastics available in the injection moulding industry in the form of pellets. From ABS to PPS to PA, the professional machine can process many polymers and especially combine several materials at the same time. Among them, thermoplastics elastomers, better known by their acronym TPE.

New Pam Series P incorporates the latest hardware and software improvements developed by Pollen AM.

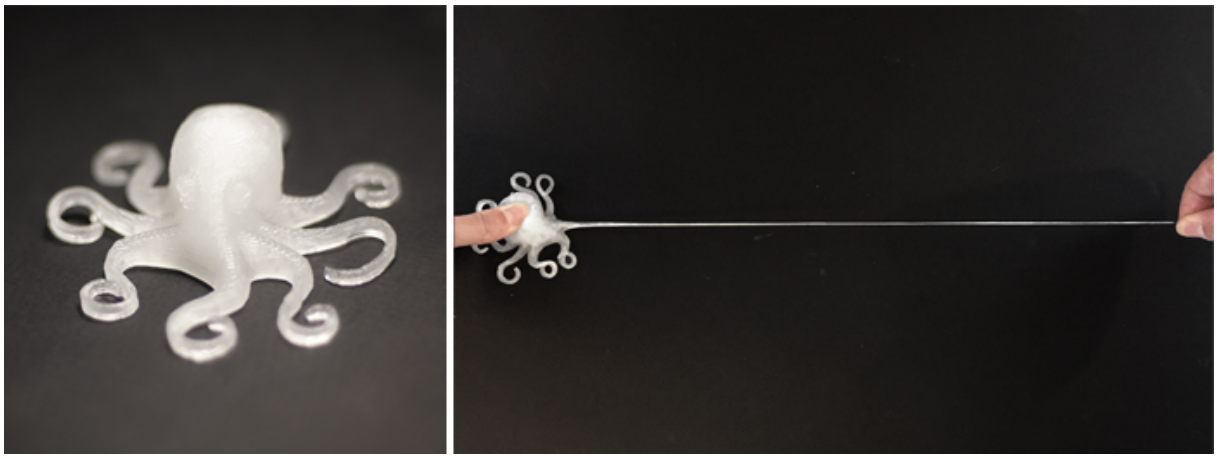
The family of very small businesses

Thermoplastics elastomers are obtained by mixing a hard material (thermoplastic) with a soft rubbery material (elastomer): it is therefore the hard material which will carry the mechanical properties while the flexible part will bring all the flexibility to the final part. Thanks to their great versatility, they are widely used in industry, especially for shock absorption, sealing or comfort applications.

Today we can classify them into 6 different families, each with specific characteristics:

- Styrenic TPE (TPS or TPE-S)
- Unvulcanized olefin TPEs (TPO or TPE-O)
- Vulcanized TPE (TPV or TPE-V)
- Polyurethane type TPE (TPU or TPE-U)
- TPE copolyster (TPC or TPE-C)
- TPE copolyamides (TPA or TPE-A)

What is interesting with these thermoplastic elastomers is the range of hardnesses that they present, called "shore hardness". It is this which indicates the flexibility of the TPE. We will use the A scale for soft materials and the D scale for the hardest. The Pollen AM solution therefore makes it possible to print any shore, from Shore 00 to Shore D. Besides, we notice that the innovation dynamic of TPE is superior to that of other thermoplastics and rubbers.



Octopus printed with a TPE-S Kraiburg, TF0STL (Shore 00)

3D printing and TPE

Today, it is certainly the TPU which is the best known on the additive manufacturing market because the polyurethane base presents a good compromise between hardness and flexibility, high mechanical properties and good abrasion resistance. Even if it offers good results, it is difficult to descend below a Shore 60A because the softer the filament, the more difficult it will be for the user to convey it into the extruder of the 3D printer. This can quickly get stuck in the machine and increase the risk of failure.

In addition to the fact that it is difficult to print a TPE in the form of a filament, it should be noted that the material does not have exactly the same physico-chemical properties as the raw material. Making a 3D printing filament involves heating the raw material; however, this operation increases its thermal history. The more important the history, the more the polymer chains are reduced, resulting in a degradation of the properties of the material. The manufacturer is often obliged to add additives or plasticizers to mitigate this degradation in which case the manufacturer cannot have the same chemistry as the raw material.

Measured properties TPE TF0STL, Kraiburg	u.m.	Pam Series P	Injection moulding	Pam Series P / Injection moulding
Hardness (DIN ISO 27588 (D=6mm)	VLRH	45	51	88%
Density (DIN EN ISO 1183-1)	g/cm^3	0,874	0,873	100%
Tensile strength (DIN 53504/ISO 37)	Mpa	1,4	1,9	74%
Elongation at Break (DIN 53504/ISO 37)	%	1178	1412	83%
Tear resistance (ISO 34-1 Method B)	%	3,5	4,2	83%

Comparison between test specimens printed with Pam technology and injected. Printed test pieces develop similar stresses and elongations

This is where the Pollen AM solution is interesting: by working in the form of industrial pellets, the material undergoes fewer transformations and has properties closer to those of injection moulding than of filament. Didier Fonta, Director of Operations at Pollen AM, explains: *"Our industrial raw material undergoes the same number of transformations as in the injection moulding industry. As a result, the end user finds more precise chemical and mechanical properties adapted to their needs. This is particularly interesting on the elastomer part because it can print without limit of hardness, from very soft to very rigid."*

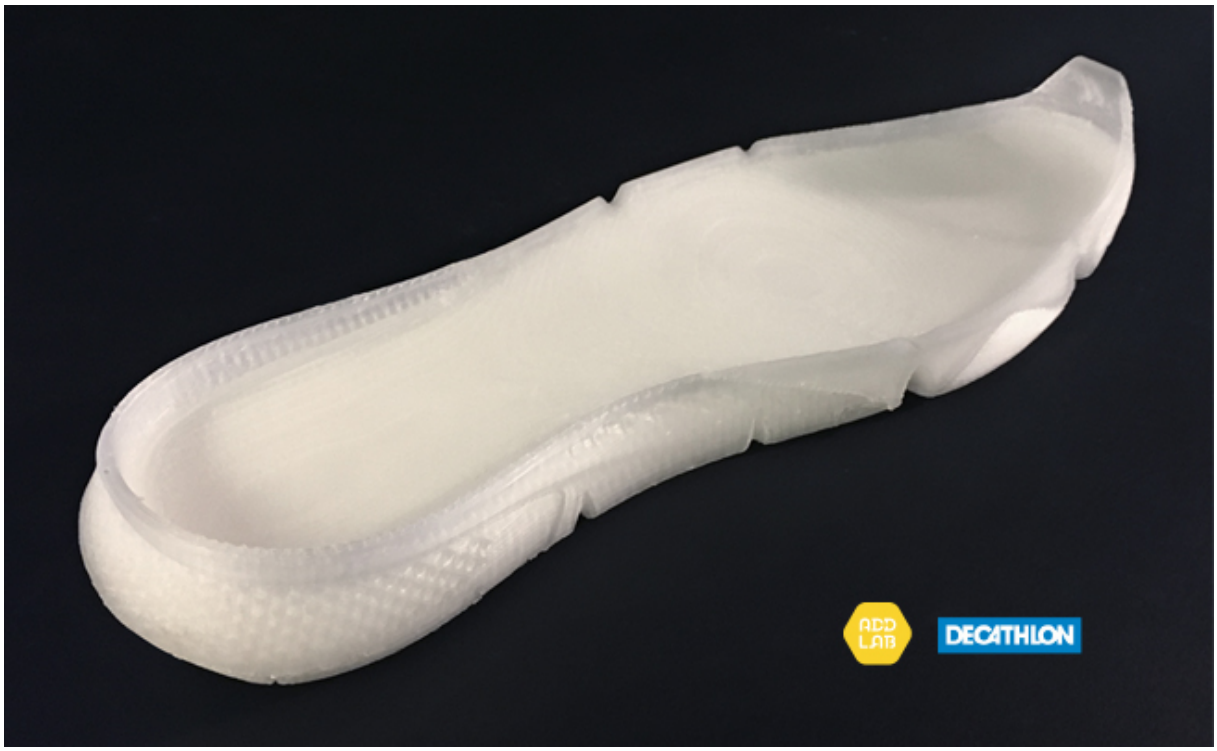
Why bet on Pollen AM technology?

As you can see, the additive manufacturing solution from Pollen AM is more than suitable for designing parts that require maximum flexibility. The company, Delta Plasturgy, uses Pam technology to produce protective equipment in small series (handling gloves, knee pads, etc.). Its patented “Hexaflex” geometry solution combines pyramidal and hexagonal shapes with TPE materials. The openness to materials of Pam technology allows it to respond quickly to a wide range of new applications.

“Hexaflex” printed geometry for protective equipment, in this example, a kneepad

Also, Pollen AM and the Decathlon Add Lab collaborated to print a sole composed of two different elastomeric thermoplastics, a TPE 70 ShA, a TPE 45 ShA and a support material based on HIPS. Didier Fonta adds: *"Our machine makes it possible to combine several elastomers at the same time which will offer the manufacturer fairly broad ranges of properties. In the case of a sole, for example, we are able to have several cushioning characteristics."*

TPE 3D printing is also popular with the automotive sector, the tooling market for creating grippers, suction cups or adding functions to existing tools, but also by the sports sector for designing equipment adapted to the athlete's morphology. In reality, we are surrounded by elastomeric thermoplastics and additive manufacturing may well increase the possibilities that these materials offer.



Printed sole in bi-material TPE

You can already see it on the Pollen AM website.