The Next Decade in 3D Printed Eyewear

A Ten-Year Forecast and Opportunity Analysis for 3D Printing in the Eyewear Industry

Table of Contents

SmarTech ANALYSIS

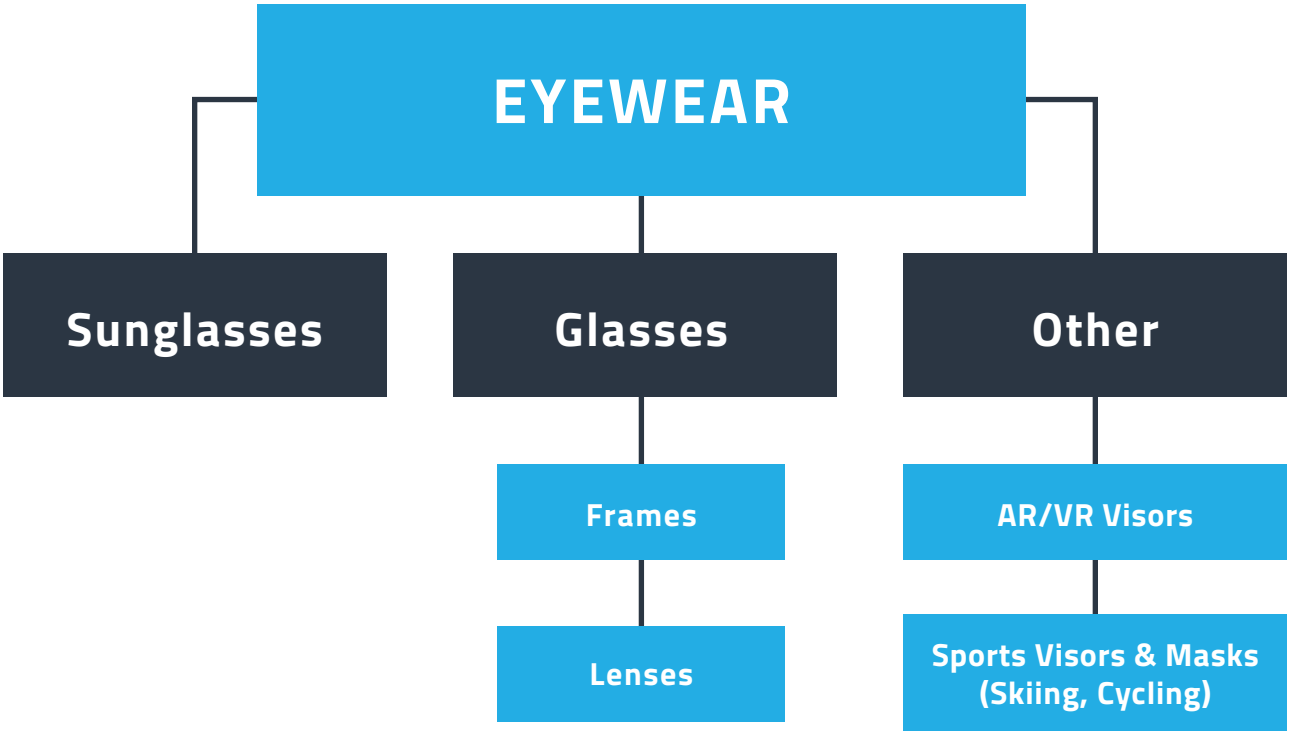
Introduction

In a timespan of around five years, 3D printed eyewear has become an exciting niche market with significant potential in the medium and long term. Additive manufacturing specialists are carrying out projects for eyewear companies, while many eyewear companies are setting up their own in-house AM technologies.

Like applications of 3D printing in dentistry and other areas, 3D printed eyewear also provides an opportunity for businesses to serve the end user directly, providing products that can be customized to a customer's preferences. 3D capture and 3D scanning devices have opened up huge opportunities in this area.

This white paper outlines forecasts and opportunity analysis in the 3D printed eyewear segment, as presented fully in the SmarTech report **"Markets for 3D Printed Eyewear 2018 – 3D Printing in the Eyewear Industry 2018."**

The Eyewear Industry



The global eyewear industry generated revenues of about $120 billion in 2018. By 2028, it could grow into a $230 billion revenue segment of manufacturing. The segment is mature and growing steadily as more people around the world are able to afford basic eye care.

The segment is expected to experience even more rapid growth rates driven by the expansion of future products such as augmented reality (AR) visors and, to a lesser degree, virtual reality (VR) headsets. Smart glass technology for sports and professional activities will also play a role.

These technologies are almost non-existent today but will experience very high growth over the next 10 years.

3D printed eyewear will grow to represent 1% of all produced eyewear by 2028. This amounts to a $1.9 billion revenue opportunity.

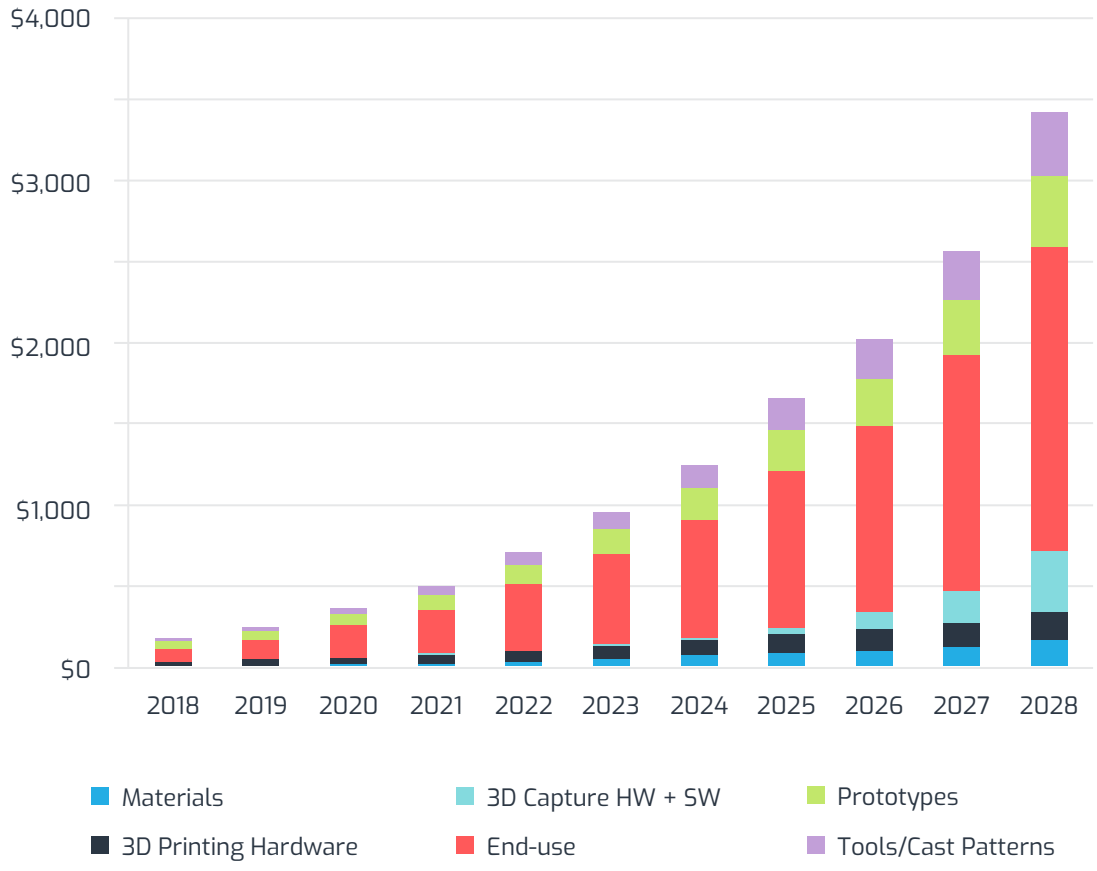
3D Printed Eyewear
Over the Next 10 Years

Additive manufacturing is expected to play an increasingly important role in the eyewear industry over the next decade and beyond. SmartTech forecasts a much higher volume of final parts production by 2028, as well as increased adoption of AM in areas such as prototyping and indirect manufacturing.

The SmarTech report "Markets for 3D Printed Eyewear 2018 – 3D Printing in the Eyewear Industry 2018" contains forecasts categorized by markets, applications and manufacturing technologies, and predicts growth in all segments within 3D printed eyewear.

The single most significant segment in 3D printed eyewear is, and will remain, final parts production, which is expected to grow into a $1.9 billion opportunity in a segment which will be worth $3.4 billion overall by 2028.

All Eyewear 3D Printing Revenues by Segment ($USM)
2018 - 2028



Drivers for Adoption of AM

The key benefits of implementing 3D printing in production are similar to those observed in most consumer products. They include:

Increased design possibilities

3D printing technologies like polymer powder bed fusion can be used to create complex shapes, including those that cannot be produced using traditional manufacturing technologies. Complex shapes can also result in lighter and more stylish products.

Customized comfort

By producing customized products, 3D printing can be used to create a tailored product for the customer. This customization often involves the support of dedicated 3D scanning technologies.

Material quality

Today's 3D printing technologies in eyewear part production use mainly nylon 12, which is a durable, flexible and versatile material. Other usable materials include glass fiber composites and other durable resins.

On-demand manufacturing

New or smaller eyewear manufacturers and designers can use 3D printing to reduce the impact of scale economics, producing limited numbers of final parts at accessible costs and gaining easier access to the market.

Obstacles to Adoption of AM

While the use of AM for direct production of eyewear will experience significant growth over the next decade, several factors are hindering its adoption.

Surface finish

Current AM technologies for eyewear create parts with rough and porous surface finishes, which do not compare favorably to the smoothness of injection molded parts. Applying finishing processes to achieve full smoothness drives up costs.

Limitations in scaling up production

When it comes to scaling up production to compete with larger manufacturers, current 3D printing technologies fall short. They are not yet suitable for producing batches of several thousand parts.

Limited Material Selection

Nylon is an ideal material for eyewear manufacturing, but there are few alternatives. Other material possibilities have not been widely implemented and will require further research and testing before they are ready for final parts production.

Factors Affecting Adoption of AM in Eyewear

Drivers

- Increased design possibilities
- Customization possibilities
- Material quality
- On-demand manufacturing

Obstacles

- Limitations in scaling up production
- Surface finish lacks quality
- Cost of post-processing
- Limited material options

The primary technology used to 3D print frames is polymer powder bed fusion, which today is used for almost the entirety of final parts production.

Hardware & Materials

The key technologies used in eyewear 3D printing are material jetting for highest level prototyping and powder bed fusion for final part production. Vat photopolymerization is used for lost wax casting processes, while filament extrusion is used for basic desktop prototyping and some end-use internal parts.

Hardware

The primary technology used to 3D print frames is polymer powder bed fusion, which today is used for almost the entirety of final parts production.

EOS selective laser sintering systems (SLS) are most frequently used, but the lower costs of HP's Multi Jet Fusion (MJF) technology make it a viable future alternative.

Both technologies work on powder beds and do not require supports, enabling production of almost any geometrical shape, and both offer build volumes that are large enough to fit several dozen full-size frames in one print job.

Future alternative technologies in the medium term include SLA and DLP photopolymerization. SmarTech expects that photopolymerization technologies will play a growing role in final part production through the use of large-format SLA technologies and the development of more durable resins, or through the use of standard DLP technologies and resins with the addition of special finishes to ensure durability.

In the longer term, final parts production is also expected to be carried out using high-speed technologies such as those introduced by Carbon and EnvisionTEC.

Image source: 3dprint.com

Latest Powder Bed Fusion Systems for Eyewear Production

Manufacturer	System	Technology	Price
EOS	FORMIGA P110 Velocis	SLS	$200,000
EOS	EOS P 500	SLS	$500,000
Prodways	Promaker P1000	SLS	$100,000
Prodways	Promaker P4500HS	SLS	$500,000+
3D Systems	ProX SLS 6100	SLS	$500,000
HP	HP Jet Fusion 3D 4210	MJF	$200,000

Materials

The primary material used in polymer powder bed fusion for eyewear manufacturing is nylon 12 (PA122), which is the most widely used material for this type of process for any application.

Some 3D printed eyewear manufacturers have developed special finishing processes to deliver a smoother surface finish and more vibrant color while reducing the porosity of the material. In particular, the company Dye Mansion has introduced an automated coloring and finishing technology which has been widely adopted.

SmarTech has also encountered use of titanium powders for luxury frames and the use of more durable photopolymer materials. Netherlands-based Boulton Eyewear was the first to implement photopolymer-based 3D printing to create consumer-ready eyewear, using technology provided by EnvisionTEC via a 3D printing service.

Additionally, SmarTech expects Carbon's layerless technology and its epoxy and polyurethane based materials to be used for eyewear production in the medium to long-term future.

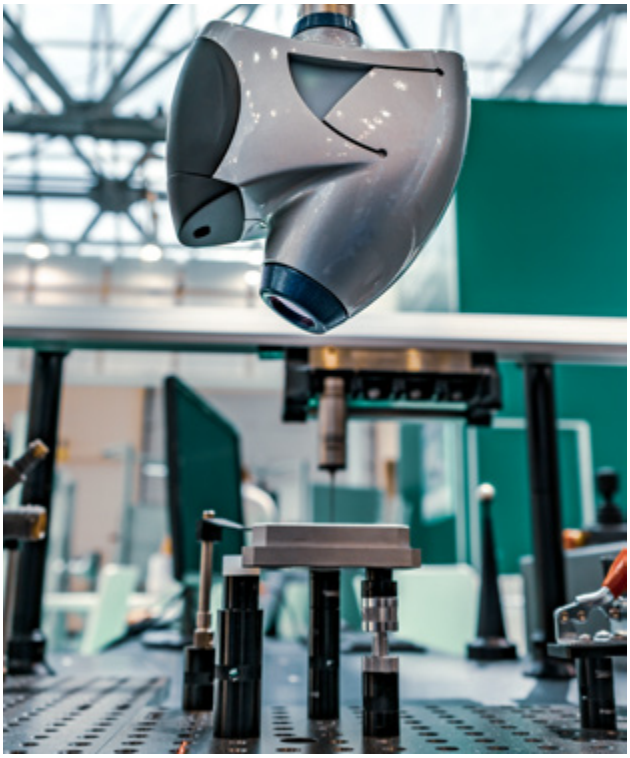
A Customized Future

The integration of customization and 3D scanning hardware and software, either online or in shops, can be a relatively seamless and inexpensive process.

Besides the potential for on-demand production, one of the biggest drivers for adoption of AM in eyewear is increased personalization — the ability to mass produce objects that are personalized for the individual client.

Personalization of 3D printed eyewear requires additional tools, but the integration of customization and 3D scanning hardware and software, either online or in shops, can be a relatively seamless and inexpensive process.

For this reason, SmarTech is forecasting a very steep curve of adoption starting toward the mid-point of the 10-year forecast period. The effects of this growth will be even more significant beyond 2028.



Companies developing customization tools for 3D printed eyewear include:

Materialse, Hoya

The Yuniku system, developed collaboratively by Materialise and Hoya, allows eye care professionals to make fully customized 3D printed frames. Yuniku eyewear is based on a vision-centric design and an open digital platform, and the system uses 3D scanning, parametric design automation and 3D printing to create frames.

Fuel3D, Sfered

3D scanner manufacturer Fuel3D has collaborated with Sfered, an eyewear technology developer headquartered in the Netherlands, to develop a mirror-based 3D scanning system for the creation of customized eyewear. The system involves precise facial scanning that allows opticians to quickly collect all metrics required for the fitting of eyewear.

Learn More

Further information about 3D printing in the eyewear industry can be found in the SmarTech report **"Markets for 3D Printed Eyewear 2018 – 3D Printing in the Eyewear Industry 2018."**

About This Report

This report analyzes the key trends and stakeholders that are driving the eyewear mass customization revolution as well as the elements that are limiting AM adoption.

Leveraging its knowledge of 3D printing processes and unique database of global AM materials and hardware sales, SmarTech explores the key applications for AM in the eyewear industry, including both current and upcoming relevant case studies, as well as probable future developments. One primary objective of this report is to highlight the most relevant business opportunities that lie ahead for companies that are invested in the AM industry, including materials, hardware and service providers.

The other primary goal is to provide eyewear industry stakeholders with an accurate description of all currently existing AM technologies, materials and services (including 3D capturing and online customization software) that could offer a powerful competitive advantage as eyewear users demand increasing customization options. While final part production is a major focus area for the medium and long term, the report also analyses other current uses of AM in the eyewear industry, such as advanced and desktop prototyping, tooling and investment casting.

For more information on the report, including a downloadable excerpt go to:
https://www.smartechpublishing.com/reports/3d-printing-eyewear-market-2019-2027/