

SYGLASS

REVOLUTION IN PREFORMS MANUFACTURING

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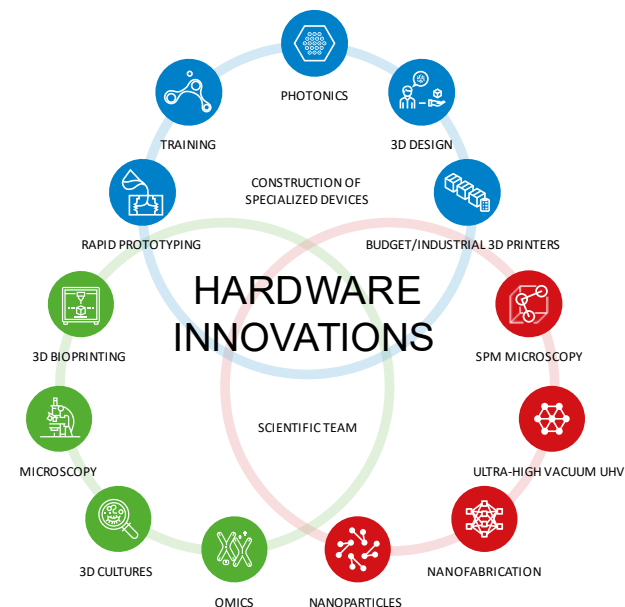
syglass.sygnis.pl

About SYGNIS

SYGNIS is a team of specialists in technological consulting, R&D projects, 3D printing, photonics, biotechnology, nanotechnology and implementation of short production series.

We bring together engineers, scientists, designers and experts of Industry 4.0.

Knowledge has layers™

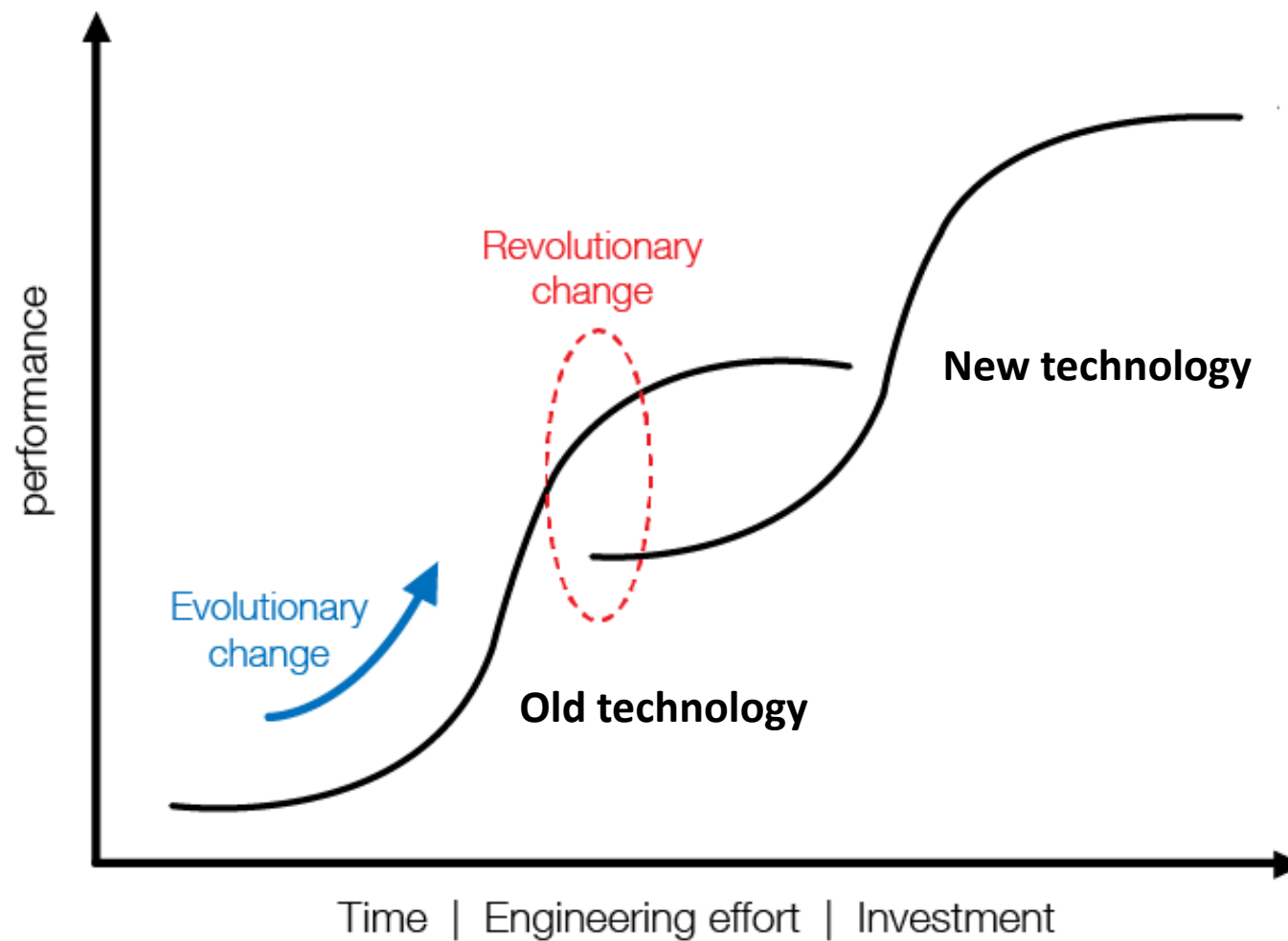


SYGLASS

**Breakthrough technology
for automated manufacturing
of gradient index optic elements**

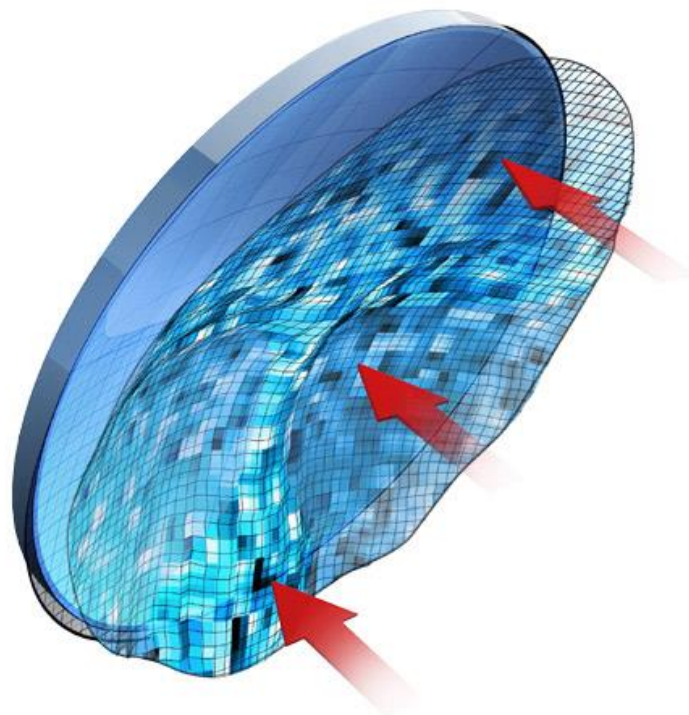


Revolutionary change



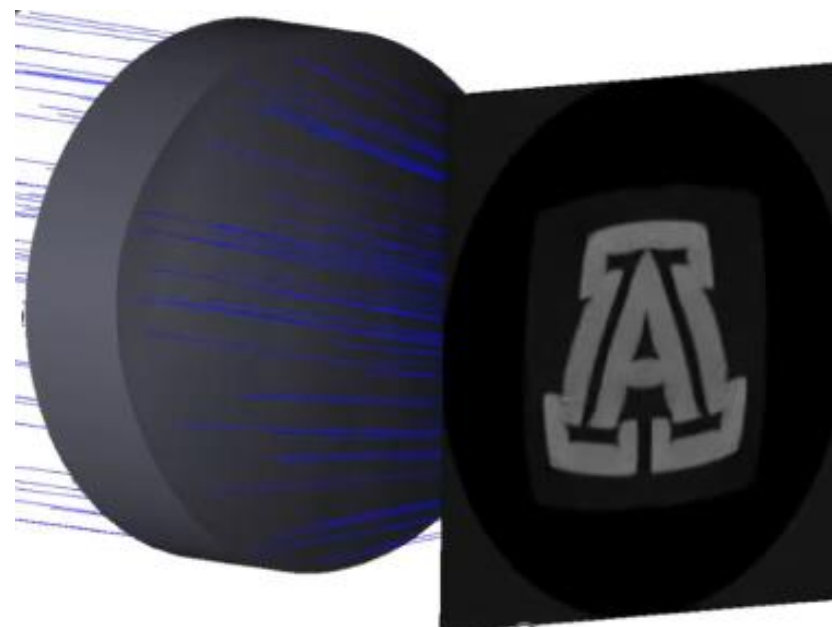
Revolutionary change - example

Freeform lens example



Old technology

SYGLASS enabled flat lenses

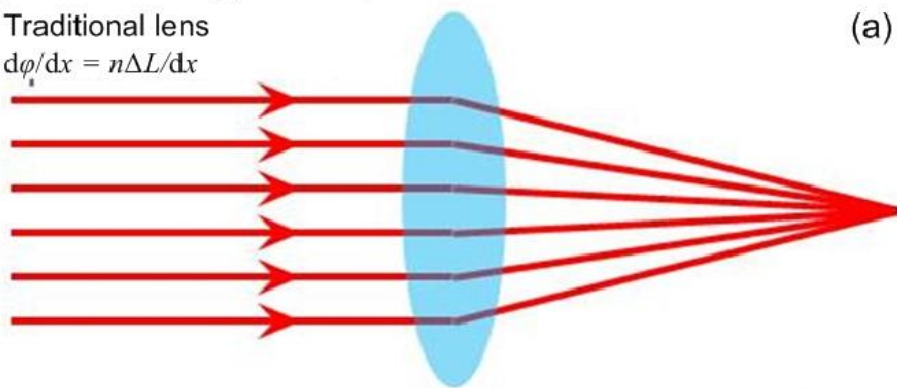


New technology

Flat lenses design examples

gradient to a hyperbolic profile.

Traditional lens
 $d\varphi/dx = n\Delta L/dx$



Tunable flat lens
 $d\varphi/dx = f(g(x)) = \text{variable}$

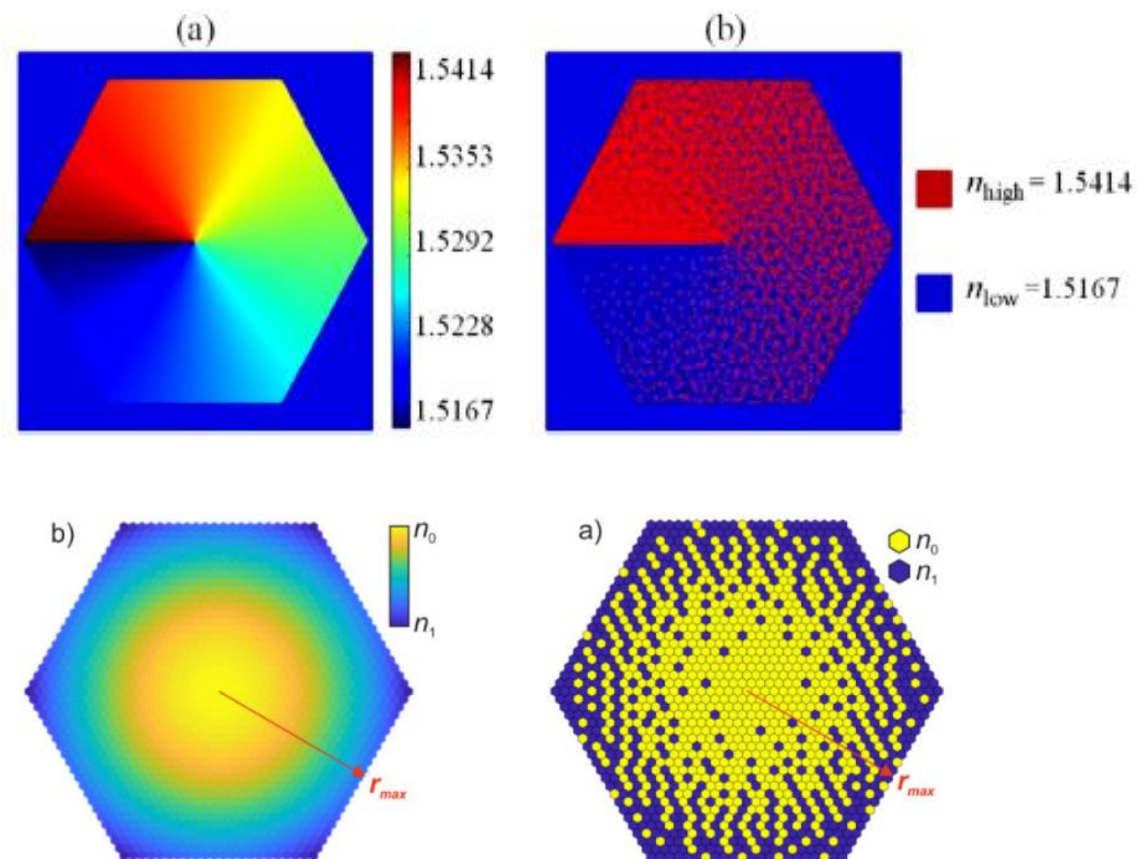
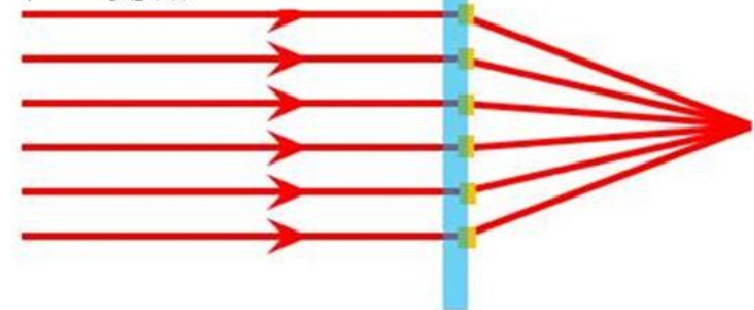
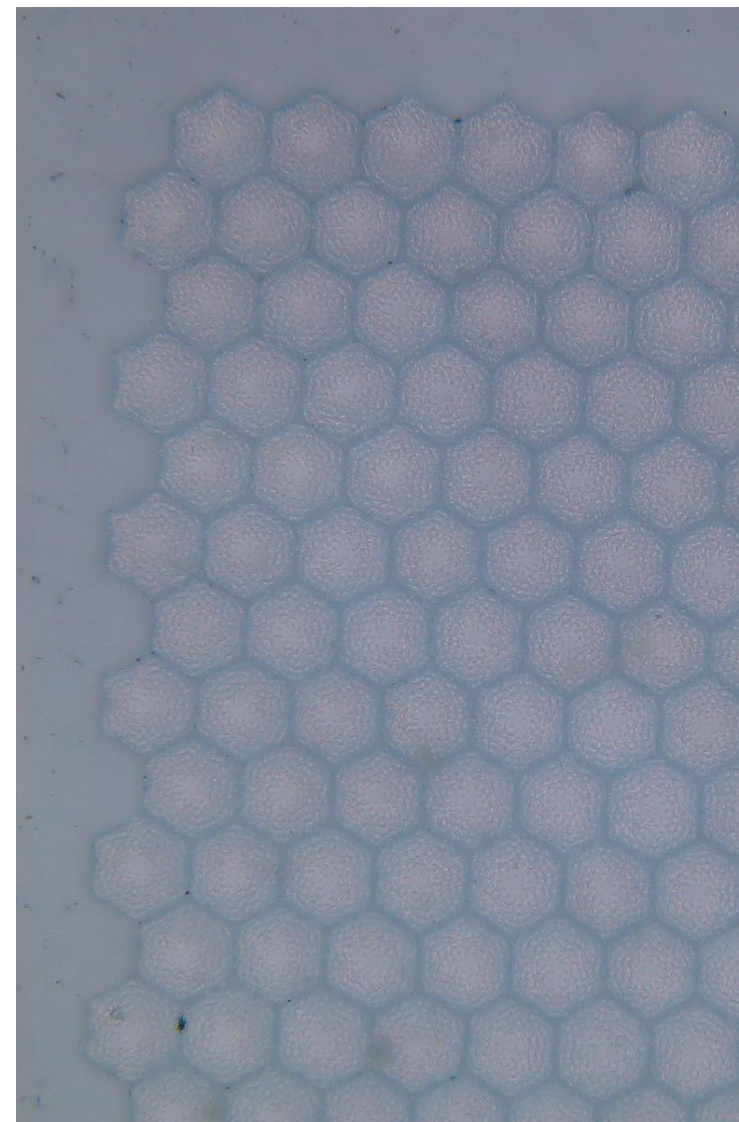
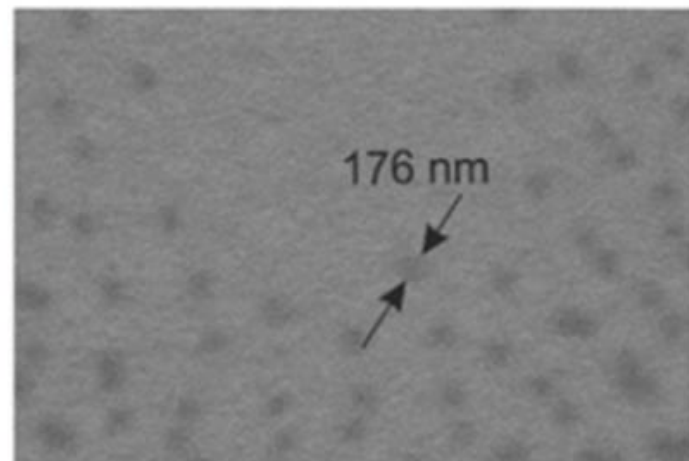
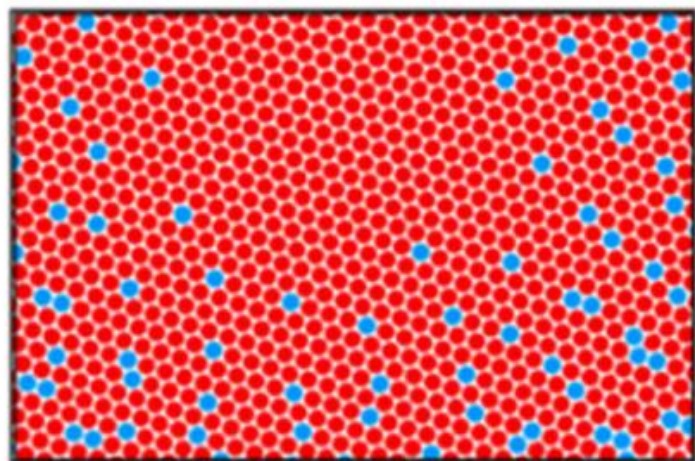
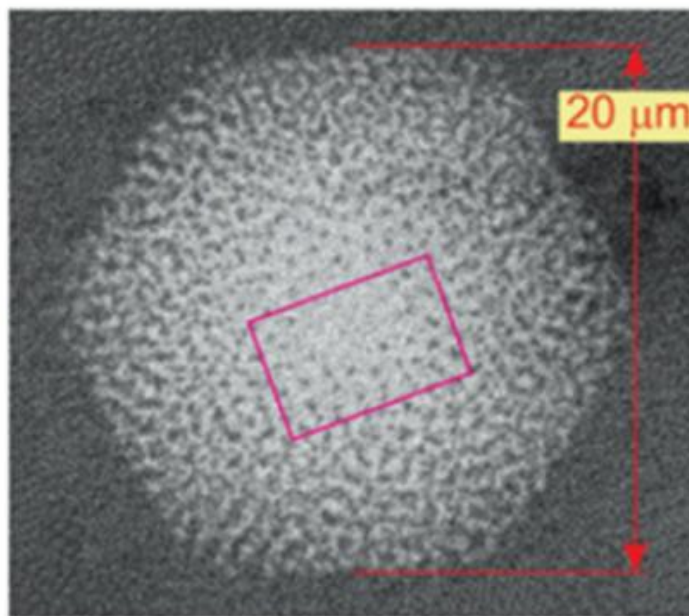
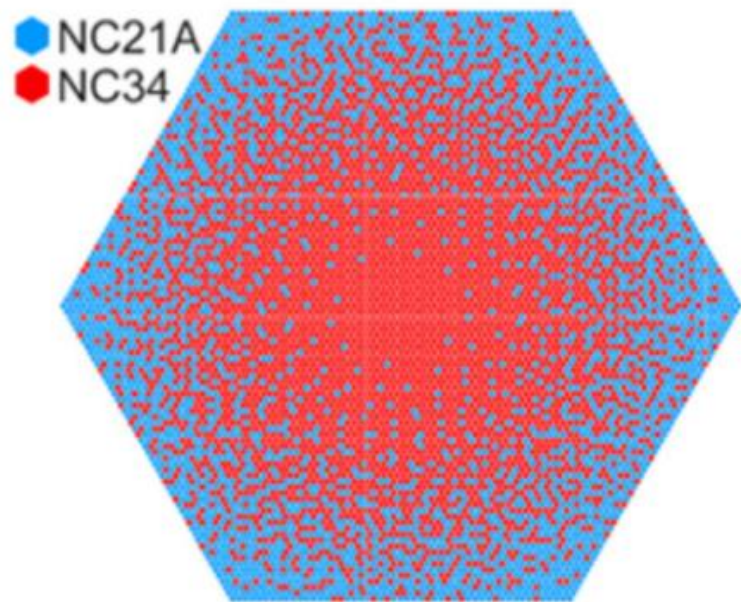
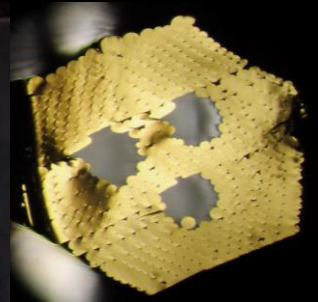
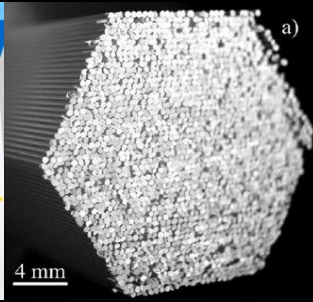


Figure 2: The working principle of the (a) traditional lens and (b)

Flat lenses design examples



FIBER OPTIC PREFORM PRODUCTION



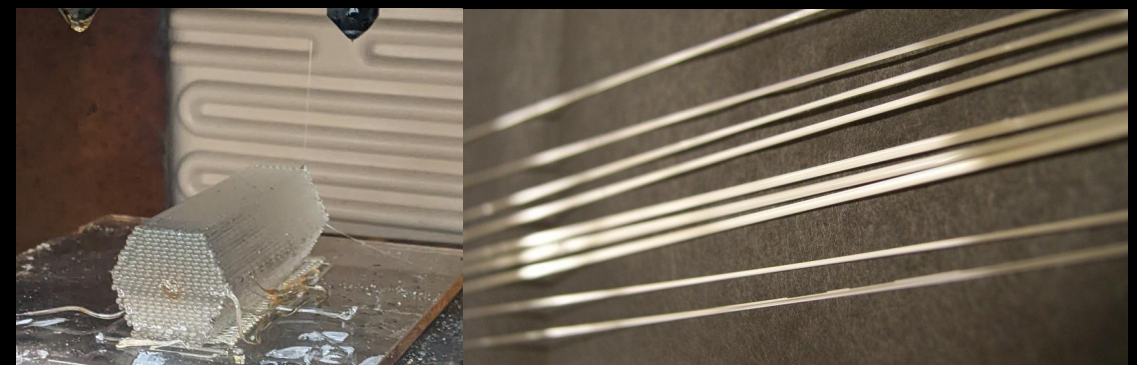
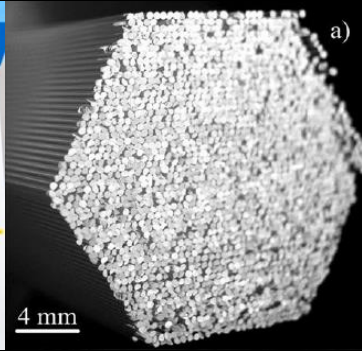
Before

vs.

Now with SYGLASS

1. Smelting of glass pipes	1 week	-	-
2. Polishing and post processing of material	1 week	-	-
3. Pulling rods to a smaller diameter	½ week	-	-
4. Cutting into smaller pieces (thousands)	½ week	-	-
5. Cleanup of every element	1 week	-	-
6. Manual stacking of tiny rods	2 weeks	-	-
7. Thermal binding treatment	1 day	3D printing of the preform with SYGLASS	1-2 days
	6+ weeks		< 2 days

BREAKTHROUGH IN PREFORM MANUFACTURING



Before

vs.

Now with SYGLASS

- **Cost of manufacturing: 10 000 EURO;**
- **Lead time: 3 months**
- **High risk of mistakes and delays;**

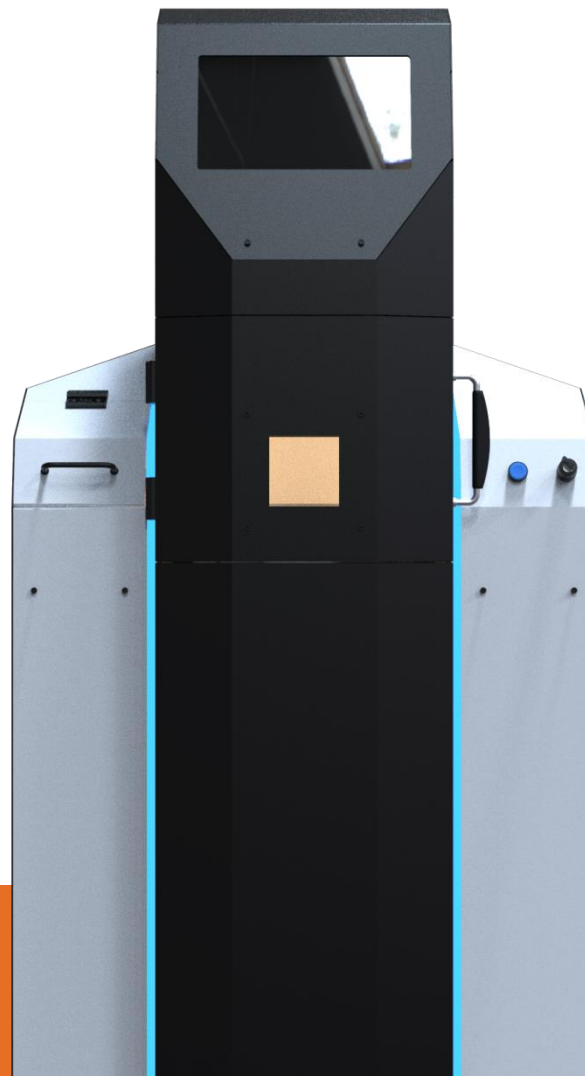
- **Cost of manufacturing: < 1000 EURO;**
- **Lead time: 2 weeks**
- **Automatic, controlled proces;**

Solution: SYGLASS

– direct ink writing 3d printing technology along with the SYGLASS 3D printer automates preform making by directly deploying melted glass in the desired pattern

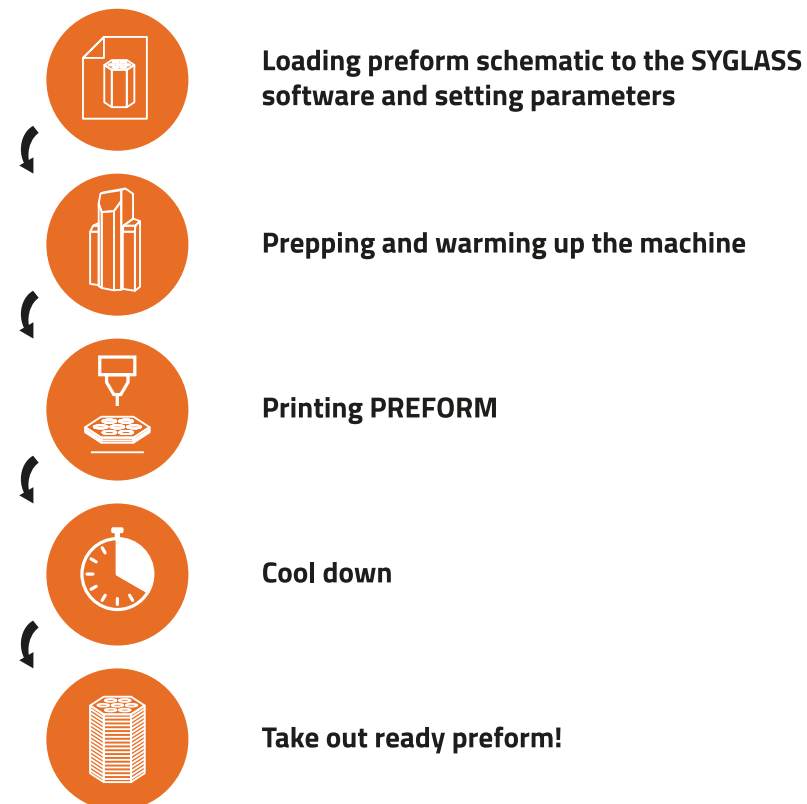
Features:

- Printout using soft glasses and other meltable materials;
- Heated chamber and printing bed;
- 3D printing with clean custom glass (made by the client or SYGNIS) without the need for post-processing or multi-stage prints;
- Working area 250 x 100 x 100 mm;
- Resolution: 0.05 mm;
- Printing speed up to 50 mm/s
- Precise temperature control of glass, table and chamber;
- Pneumatic retraction;
- Printing from two printheads and two types of glass in one process.



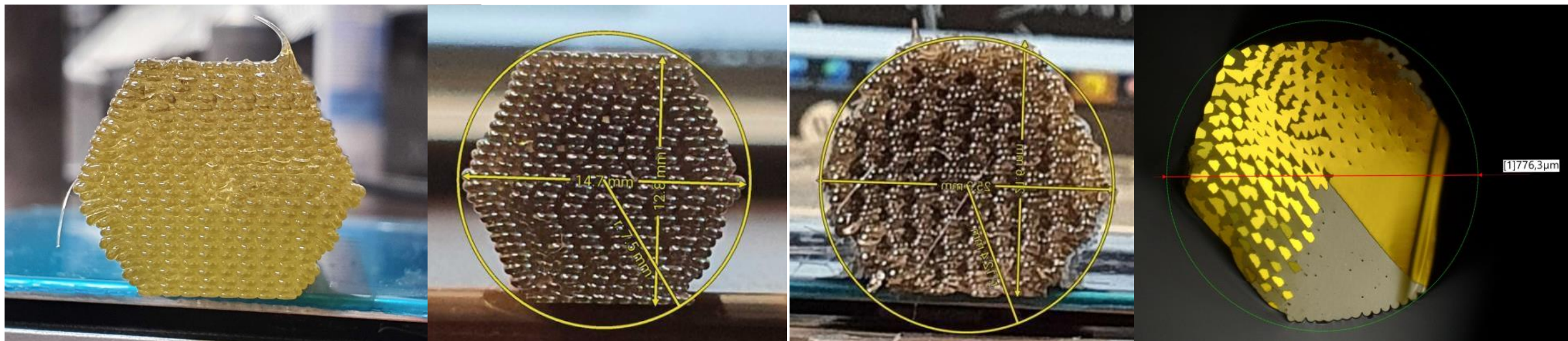
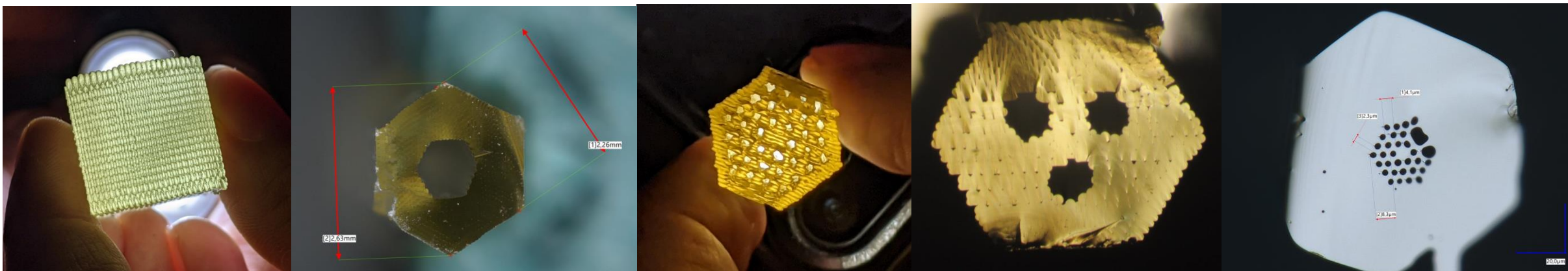
Total print time: up to 24h

The entire process requires only a single worker to operate the machine

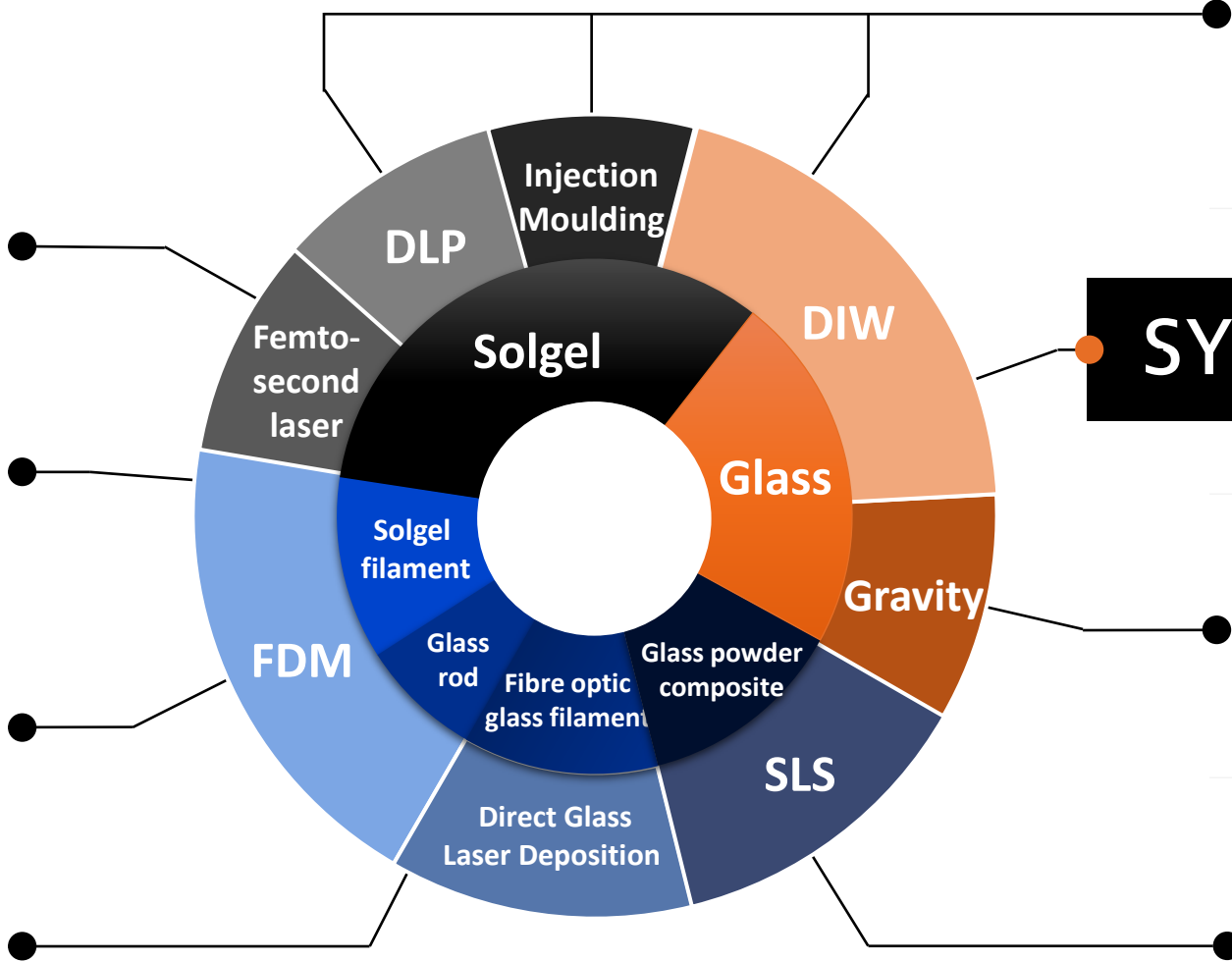


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Development – by results



Other glass 3D printing methods and types of glass



SYGLASS_01



Competition - 3D printing methods and types of glass

	working area too small for preform printing < 5 x 5 x 5 cm	working area suitable for printing preforms > 5 x 5 x 5 cm
printing with two types of glass	<p>Glassomer, 3dresyns – DLP, DIW, STL, IM</p> <ul style="list-style-type: none"> ▪ Very long hardening time (several days); ▪ Impossible to completely remove impurities from the printout; ▪ Requires multi-stage process to add another type of glass; ▪ Requires molds for new models or arranging templates inside. <p>X</p>	<p>SYGLASS_01</p> <p>– Direct Ink Writing</p> <ul style="list-style-type: none"> ▪ Prints with two types of glass in the same process; ▪ Clear glass printing; ▪ No reworking required; ▪ Possible large print size (long preforms). <p>✓</p>
printing with one type of glass	<p>Nanoscribe, Femtica, Nobula3d - Laser</p> <ul style="list-style-type: none"> ▪ Too small prints; ▪ Porosity; ▪ One material. <p>X</p>	<p>Maple, Micron3D – FDM</p> <ul style="list-style-type: none"> ▪ Requires preparation of filament in the form of brittle glass tubes; ▪ No retraction control. <p>X</p> <p>University of Southampton - SLS</p> <ul style="list-style-type: none"> ▪ High porosity; ▪ Very low transmittance. <p>X</p>

Applications

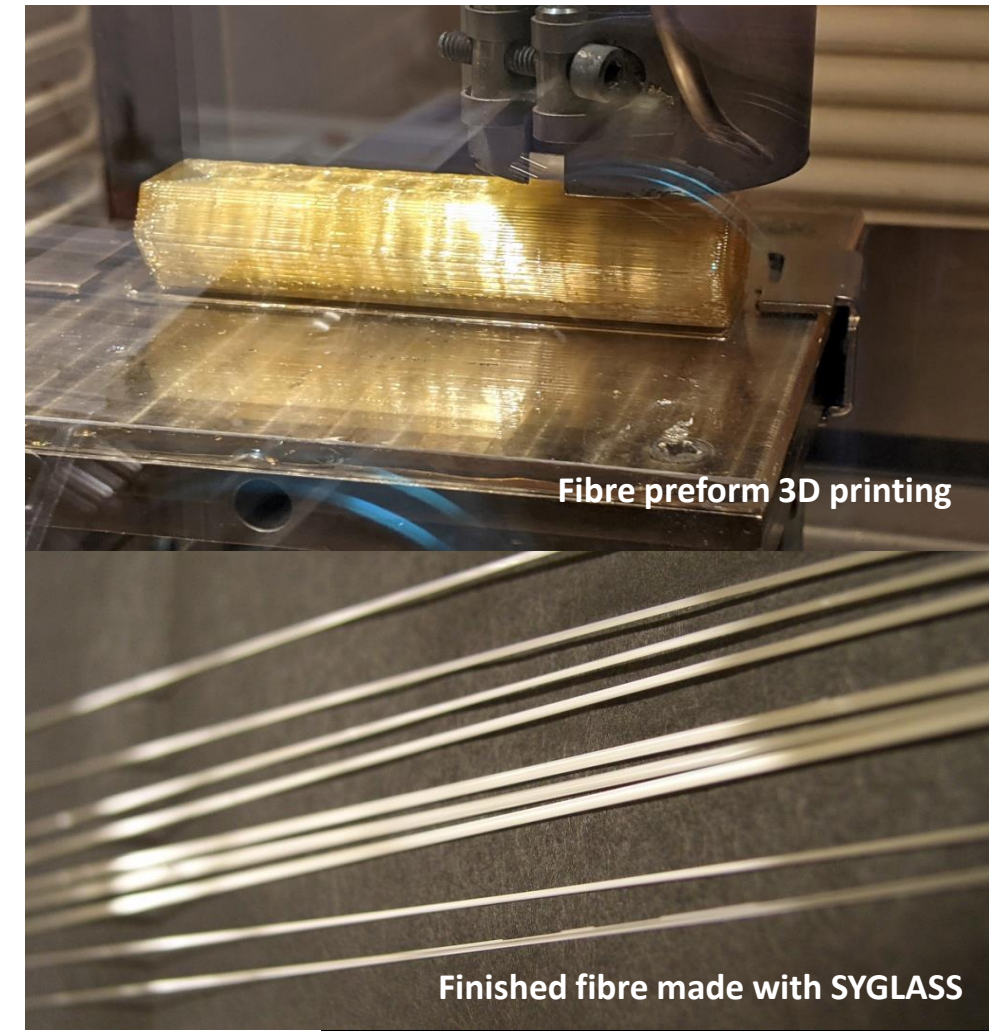
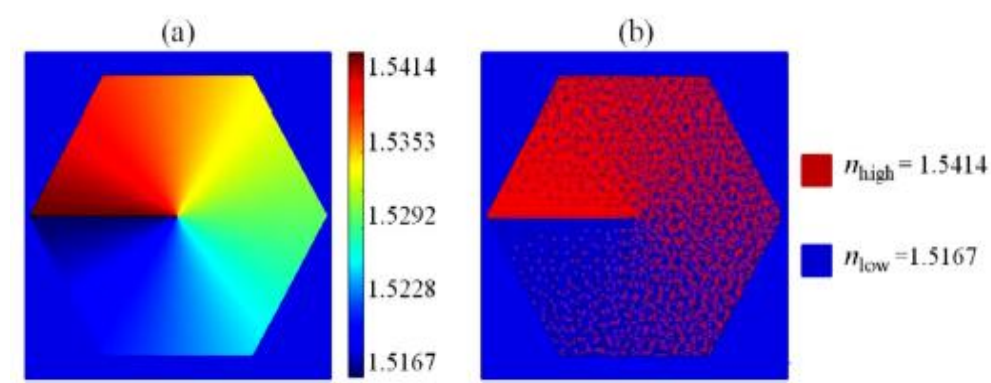
Advanced photonic based solutions finally possible with SYGLASS:

General for the photonics industry

- The only in the world capability to manufacture all-fibre flat lenses and fibre optic cables at scale with free-form core shapes,
- Reduction of price and manufacturing lead time of the custom optical elements,
- Advanced mid-infrared systems - making them compact, lightweight and robust, increasing imaging resolution and improving transmission.

Environmental and industrial sensors

- Air quality monitoring and greenhouse gas emissions measurement,
- Tracing pollutants, and contaminants in the air and water e.g. bacteria, chemicals using mid-infrared spectroscopy.



Applications

Advanced photonic based solutions finally possible with **SYGLASS**:

Healthcare

- Non-invasive treatment and diagnosis of cancer with all solid structured fibre for the mid-infrared spectral region,
- Novel skin treatment optical tools.

Communication and cybersecurity

- Increased data transmission capacity using multiple modes allowing data streams to be transmitted via different channels over a single fibre optic cable,
- Security: hardware secured fibre optic cables with vortex beam converter,
- Reliable wireless transmission in adverse weather conditions and working for much greater distances while retaining its properties, using vortex communication,
- Improved quality: all-fibre parabolic (GRIN) and PCF cables.



SYGNIS
SPÓŁKA AKCYJNA

Fibre optic drawing tower
– one of 6 machines needed for fibre manufacturing

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SYGNIS S.A.

