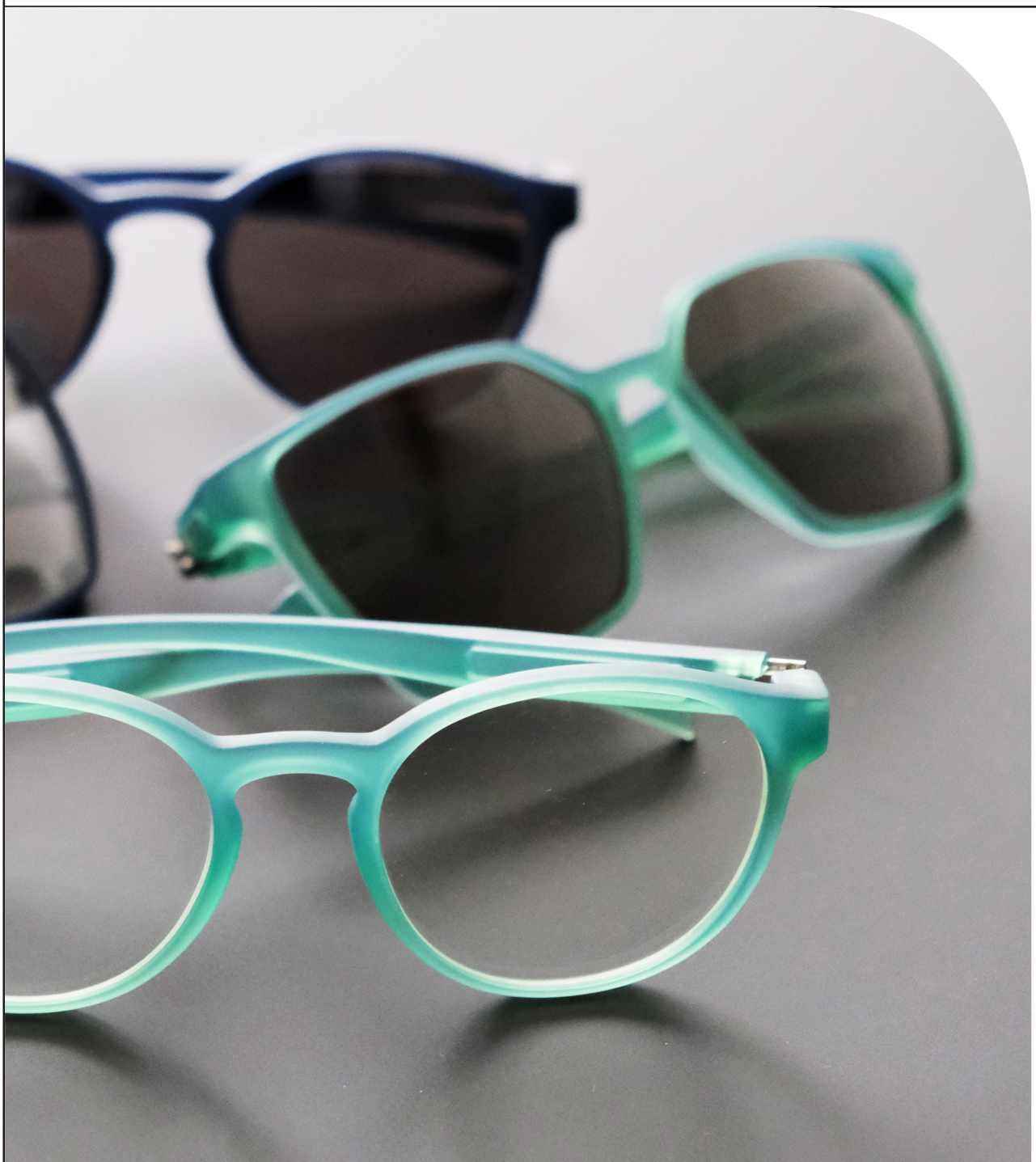
ARKEMA

Case study

GENERA

Personalized fashion eyewear frames made with N3xtDimension® liquid resin



SUMMARY

PARTNER

GENERA.

www.genera3d.com

MARKET
Consumer goods

APPLICATION
Fashion eyewear

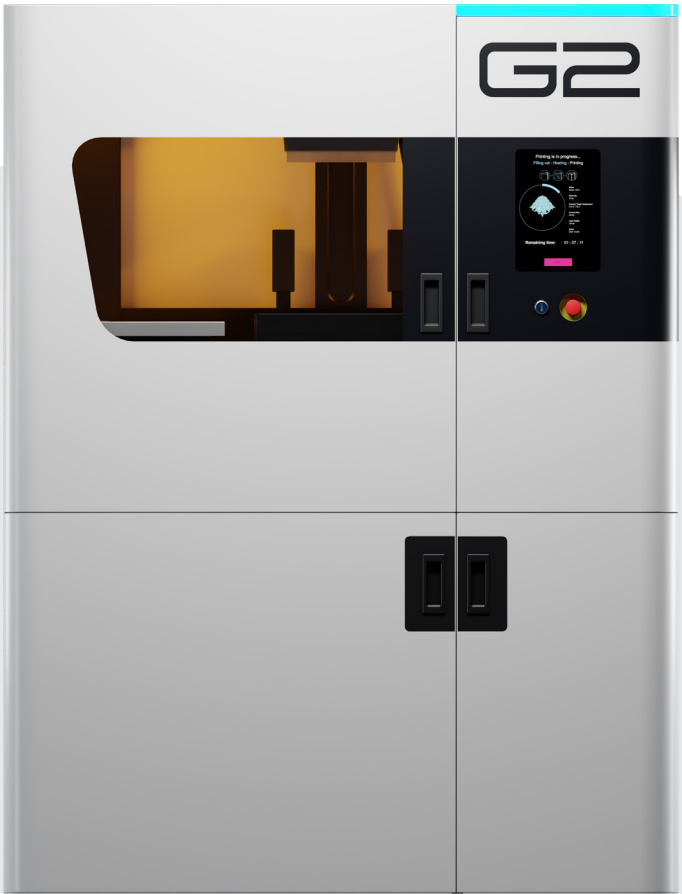
TECHNOLOGY
Digital Light Processing (DLP)

MATERIAL
N3xtDimension® N3D-GEN976

CASE STUDY

INTRODUCTION

The advent of 3D printing technologies is revolutionizing various industries such as consumer goods and lifestyle, and eyewear production is no exception. By harnessing the power of 3D printing, the eyewear industry can now benefit from advantages previously unattainable through traditional manufacturing methods. The most compelling aspect is the ability to achieve unmatched personalization and a perfect fit for individuals. By leveraging 3D printing, frames can now be tailored to precisely match the wearer's face width, shape, length of nose, and position of ears, among other parameters. This level of customization ensures optimum comfort, ergonomic design, and a seamless eyewear integration into an individual's unique features. UV-curable liquid resins with DLP printers further enhance this process, enabling accelerated printing speed, flawless surface finish, and a broad spectrum of colors and aspects, from transparency to opacity. This cutting-edge technology offers the production of intricate designs and lightweight frames that perfectly complement the wearer's style and needs.



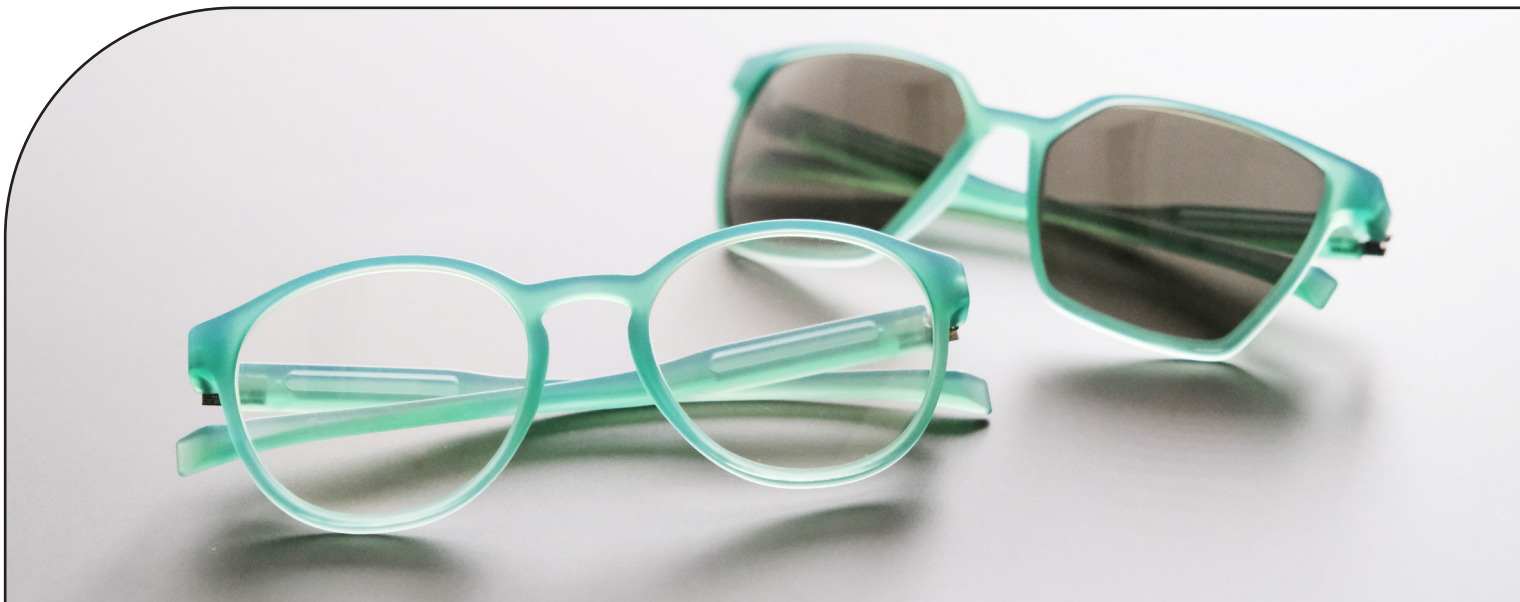
Designing 3D-Printed Eyewear

CHALLENGE

UV-curable 3D printing for mass manufacturing of glass frames presents challenges related to handling and improper use of liquid resins, including their safety characteristics. Multiple manual post-processing steps involving part cleaning, post-curing and support removal further add complexity to the production process. Ensuring proper ventilation and safety measures becomes crucial due to the potential emission of volatile organic compounds (VOCs) during printing and curing. Ongoing development aims to improve resin handling, develop safer formulations, and optimize post-processing techniques—thus enabling clean, safe and cost-effective technology. Additionally, achieving desired mechanical properties comparable to traditional manufacturing materials, including durability and flexibility, is a crucial part of the challenge. Overcoming these difficulties will enable UV-curable 3D printing to offer highly customizable and precisely fitted glass frames while maintaining a safe and efficient manufacturing process. In this case study, we will examine how Arkema and GENERA have joined forces to bring a convincing answer to this challenge.

The set of requirements for 3D-printed frames material was established by GENERA following an extensive study and benchmarking of traditionally-manufactured frames on the market.

Properties		Specifications
Viscosity @ 25°C (mPa.s)		< 3000
Hardness Shore D		> 75
Tensile Properties	Young Modulus (GPa)	> 2,5
	Elongation at Break (%)	> 8
Impact Resistance	Notched IZOD (kJ/m²)	> 2
HDT B @ 0,45 MPa (°C)		> 65



SOLUTION

GENERA's systems offer a unique platform for safe and efficient handling of UV-curable resins

GENERA has developed a fully automated workflow, from print-job to post-processing, with minimal user intervention required to answer the concerns about handling UV-curable liquid resins. The user of GENERA's systems never interacts with the liquid resin and only retrieves the part after cleaning and post-curing steps. Throughout the process, GENERA guarantees optimal ventilation and evacuation of VOCs, prioritizing safety. To ensure complete traceability and repeatable results, an RFID chip is implemented, which monitors and controls the printing, cleaning and post-curing parameters, thereby optimizing the mechanical properties of the final product.

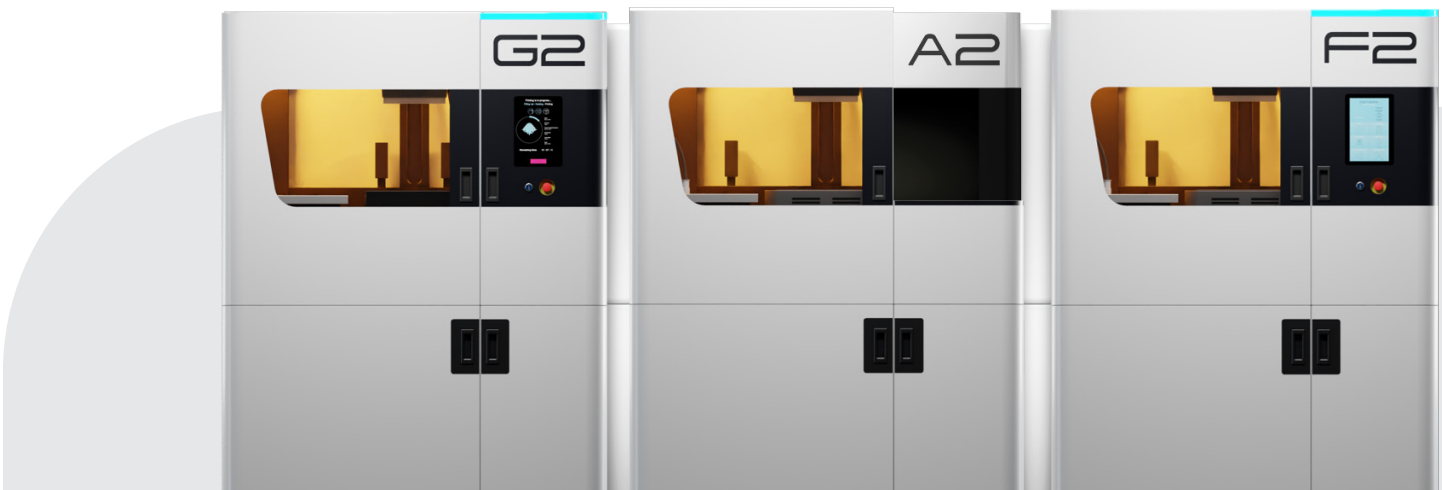
Introducing N3D-GEN976: A breakthrough material for enhanced mechanical properties

Arkema has worked hand in hand with GENERA, developing an innovative solution to the challenge of balancing toughness, durability and wear comfort through iterative steps towards the end-solution and on-machine printing trials. Leveraging Arkema's expertise in polymer science, structure-properties relationships and material formulation, the resulting material is the exclusive **N3xtDimension® N3D-GEN976**, tailored to both eyewear frames application and GENERA's systems.

The mechanical properties of the material, after printing and post-curing are summarized in the table below:

Properties		Specifications	N3D-GEN976
Viscosity @ 25°C (mPa.s)		< 3000	1640
Hardness Shore D		> 75	75
Tensile properties	Young Modulus (GPa)	> 2,5	2,9
	Tensile strength (MPa)	> 55	63
	Elongation at break (%)	> 8	8,6
Impact resistance	Notched IZOD (kJ/m²)	> 2	2,3
HDT B @ 0,45 MPa (°C)		> 65	67
Tα (°C)		NA	91

This balance of properties, in particular the impact resistance and Young Modulus compromise, as well as the unique aspect of the untainted material was achieved by leveraging Arkema's impact modifiers.

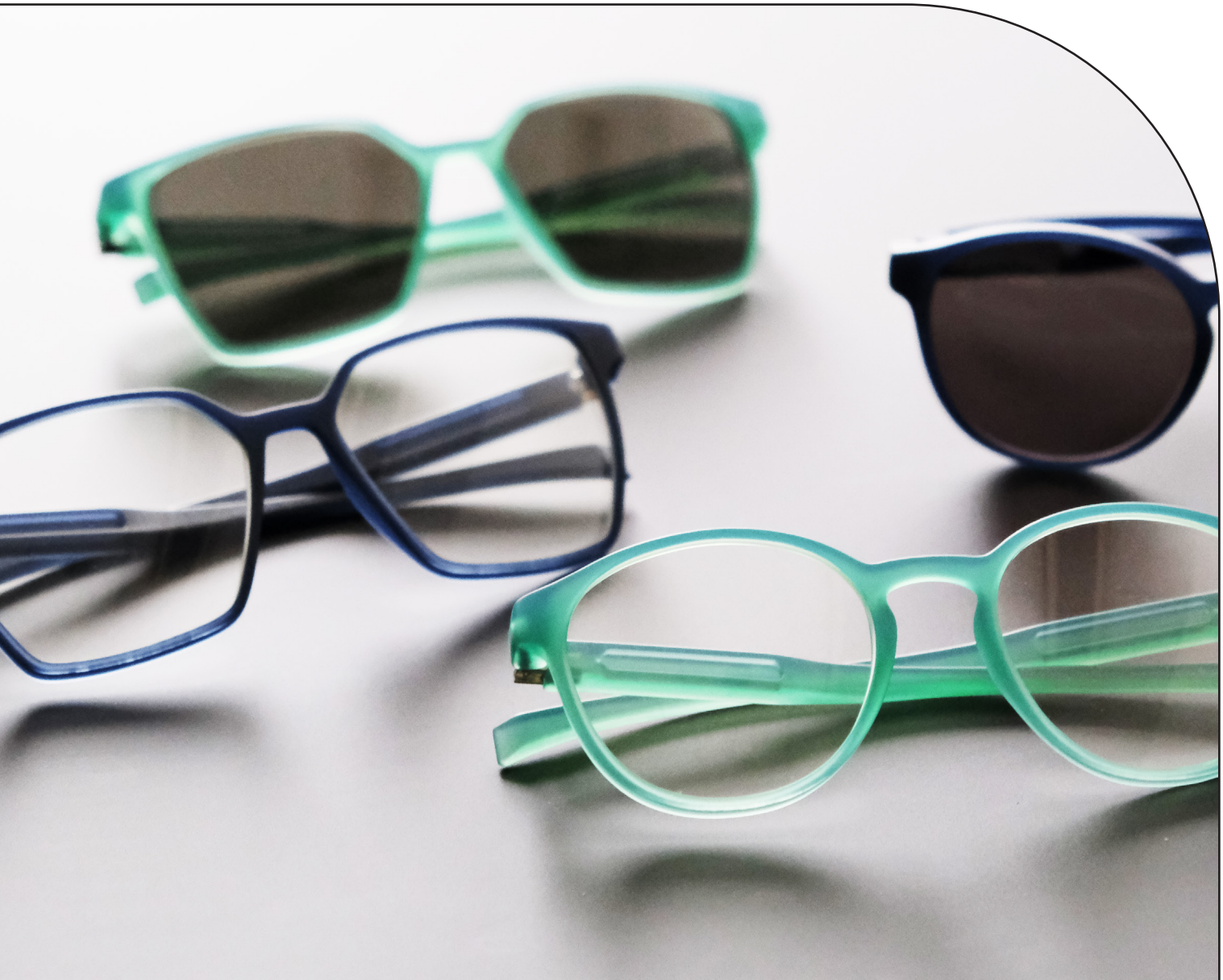


OUTCOME

The successful case study presented here exemplifies the transformative power of **innovative collaboration** between GENERA and Arkema in developing 3D-printed eyewear frames. By combining **tailored, high-performance materials and a fully automated customized manufacturing process**, they have enabled the production of eyewear frames that perfectly match individual needs and preferences, showcasing the true potential of customization. This collaborative approach has paved the way for:

- **Enhanced personalization**
- **Improved comfort**
- **Optimized mechanical properties**
- **Faster production of 3D-printed eyewear frames**

The material developed by GENERA and Arkema will be released in GENERA's material library along with a validated printing and post-processing workflow, including GENERA's non-flammable cleaning fluid GENERA Clear3D, ensuring high-throughput, repeatability, and prioritizing user-safety for their industrial grade systems.



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