Luxexcel

OPTICS INNOVATIONS

Enabled by 3-D Printing

For two optics companies, additive manufacturing has opened new business opportunities.

Sarah Michaud

Recent advances in materials science and 3-D printing technology have broadened the palette of printable materials to include not just plastic and metals, but also glass. These advances, combined with improved scanning and printing software, enable the printing of macro-scale optical elements—such as lenses and prisms—that can now meet the high standards of transparency and structural integrity demanded by the optics industry and its customers.

Luxexcel and Double Helix are two optics-based companies that have begun to use additive manufacturing, technology that builds 3-D objects by adding layer-upon-layer of material. We talked with both firms to get their perspective on how they and their customers are using 3-D printing for macro-scale optics, and how this technology enables business growth.

Luxexcel

Luxexcel, a 30-person company with two locations in the Netherlands and Belgium, started out in business doing 3-D printing of lenses for light-emitting diodes. As technology improved, the business evolved to include other application areas.

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Now, after many rounds of technological and material revisions and upgrades, Luxexcel is producing lenses that are of high enough quality for imaging and ophthalmic applications. In fact, during an interview, Luxexcel chief marketing officer Guido Groet donned glasses with lenses he printed himself.

Micro-droplet printing for seamless lenses

Luxexcel's unique 3-D printing process, "Printoptical," starts with a monomer that has an Abbe number of 45 and a refractive index (RI) of 1.53. Next, a customer's computer-aided design or a patient's lens prescription is uploaded to the printer.

Software determines where micro-droplets of the monomer should be placed. Once deposited, the layers of micro-droplets melt into each other to form a seamless solid structure—unlike the structures created via traditional 3-D printing that have visible layering. Then, when exposed to ultraviolet light, the monomer cures into a stiff polymer.

Groet says Luxexcel has two types of customers: prototypers from different fields, including the aerospace, lighting and automotive industries; and ophthalmic professionals. Those in the ophthalmic industry, says Groet, are the future focus of the company. "The optics market is huge, and customization is also big right now. We're the only group in the world, as far as I know, that can print lenses that don't require polishing post-production," says Groet. An additional benefit of 3-D printing relative to traditional manufacturing of ophthalmic lenses, according to the company, is a significant reduction in waste.

The right fit

The ophthalmic industry requires customized products in significant volumes with short lead times—which 3-D printing can offer. Luxexcel's acrylic lenses aren't manufactured layer-by-layer, but rather, microdot-by-microdot. This process creates optically superior and strong lenses, and opens up the possibility of inserting different elements into the lens while being printed. This way, says Groet, "a customer could choose to integrate different sensors or filters inside the lens without disrupting the shape or refractive index of the lens."

Luxexcel's 3-D printers can also make lenses with gradient-index (GRIN) optics. GRIN lenses have a gradual variation in RI; although flat, they "act" like curved lenses. Flat-surface GRIN lenses are easier to mount into frames or small spaces than traditional curved lenses, making them ideal for instruments or applications where space is limited.

While their lenses aren't yet ubiquitous in ophthalmics, Groet says the Luxexcel team is "quickly closing in" on the industry. In addition to developing printing materials with higher RIs, the team also hopes to place Printoptical printers closer to their ophthalmic customers around the world.

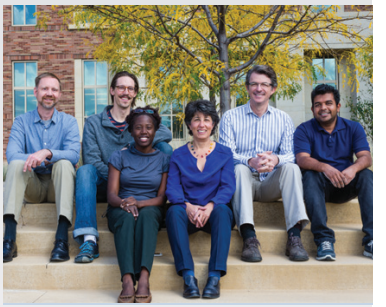
LUXEXCEL

LOCATION
Netherlands, Belgium

EMPLOYEES
30

ESTABLISHED
2009

WEBSITE
www.luxexcel.com



DOUBLE HELIX LLC

LOCATION
Boulder, Colorado, USA

EMPLOYEES
8

ESTABLISHED
2012

WEBSITE
http://doublehelixoptics.com