3D PRINTING

Bespoke lens breakthrough

Vision Expo East debuted some innovative lens creation technology from Luxexcel. **Mike Hale** reports

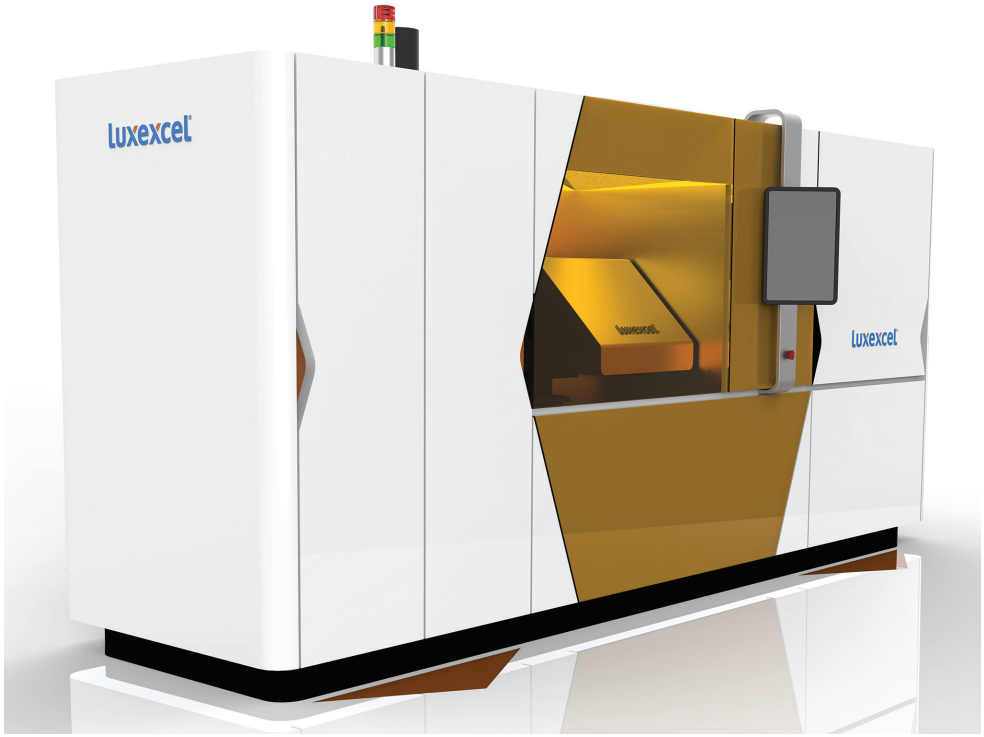
Even at the large international tradeshows like Vision Expo East, where the best and brightest of the global optical industry congregate, genuine innovation is a relatively rare find. This is perhaps all the more true of the lens sector which is more incremental in its developments than most. So it is no surprise that the unveiling of an entirely new way of making lenses in New York last month caused quite a stir.

At the show Luxexcel introduced its platform of industrial grade 3D printers, lens design software and workflow integration tools which allows for the production of 3D printed ophthalmic quality lenses. The lenses produced are fully compliant with industry standards and are compatible with the normal subsequent laboratory processes including coating and edging.

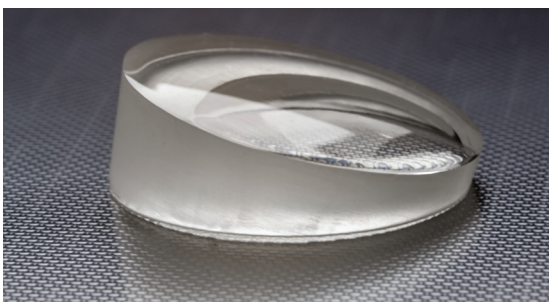
'The lenses are constructed out of little droplets,' says Guido Groet, chief marketing and sales officer at Luxexcel. 'Each droplet is minute, measuring just 8 picolitres [a picolitre equal to one trillionth of a litre], and a single lens features roughly a billion droplets.

'In simple terms for the construction, you have the print table which goes back and forth under the print heads and every time its goes underneath it precisely places a new layer of droplets. The droplets eventually merge into the form of a lens which is then cured.'

The machinery allows for four unique lenses to be constructed at the same time with the process taking one hour in total.



The Luxexcel machine will be supplied to three labs later this year



3D printed prism lens

The Luxexcel material produced is said to be similar to Trivex in terms of properties. It has an Abbe number of 45 and a refractive index (RI) of 1.53. Groet says the specific weight of the material is 1.15g/cm^3, lighter than most ophthalmic materials and additional materials with higher refractive index are being developed.

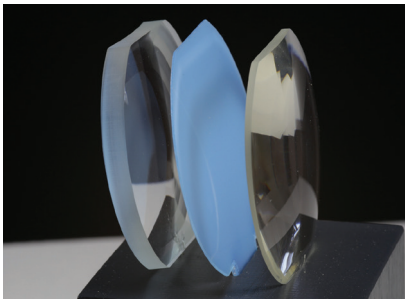
'The use of droplets allow us to build the lens in any shape or size you like and to any design,' says Groet. 'It is ready to be coated as soon as it comes out of the printer.'

The fact that the lens is ready to be coated at this stage is key to understanding the difference this technology can have on lab processes.

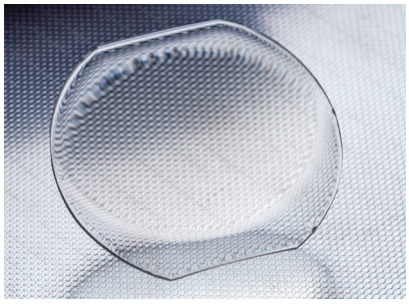
To arrive at the point where a standard lens is ready to be coated, a lens blank will be manufactured either within the lab or shipped from a large manufacturing plant. When required the blank is then blocked (attached to a piece of metal alloy) to ensure the lens is mounted securely for subsequent processes which involve cutting and grinding away the excess material followed by polishing before being deblocked (removed from the piece of metal alloy) and cleaned. Overall this involves several manual handling and also many processing steps that require complex machinery.

'All those blanks are not necessary with our technology,' says Groet. 'The blocking machine is not needed, the tapers are not needed, the generator is not needed, the polisher is not needed, the laser marker is not needed, the deblocker is not needed and the cleaning step is not needed. That's a lot of expensive and space consuming equipment. Also traditional methods wastes roughly 80% of the lens material. We only use exactly what is required and also low water and low energy.

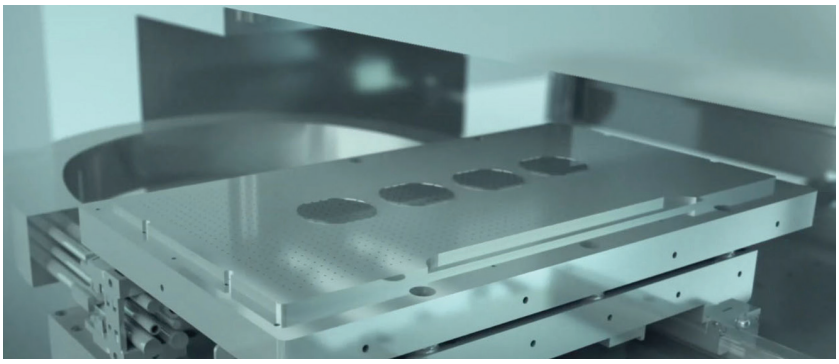
'However, for the foreseeable future



Tints can be embedded in the process



Example of a 3D printed lens



Lenses are built droplet by droplet

Sunglass with switchable 3D printed lenses

3D printed lenses in an optical frame

The lenses can be used in virtual reality devices

Luxexcel does not envisage competing on the volume side of the lens market.

'Eventually we would be in a position to turn up the speed and there's no reason why we shouldn't make 60 lenses per hour and compete on volume with the big lens companies,' says Groet. 'However, there's so many unique things we can do; we want to make products that the traditional lens companies cannot do, not replace them.'

Luxexcel has identified specialist lenses as the initial focus for its technology.

'Our technology can print many different lenses and since we like to take small steps in our development, we have decided to run our print setup at a conservative speed of four lenses per hour initially. We are focusing on low volume, high value products, which can be characterised under the term special. These will include difficult to make lenses including slab-offs, prisms, and high dioptres. We also include optical customisation: put the intermediate zones or reading zones where required instead of making it dependent on the available blank, add a-spheres to achieve optical properties or thinning.'

The initial commercialisation of the Luxexcel platform will see it installed in three lens laboratories before the end of 2017. Two of these will be in the US with the first scheduled for the third quarter of the year.

'For now we best suit labs that have a necessity for the products that we intend to initially focus on. We are in discussion with a number of customers in Europe.'

At Vision Expo East a large part of the Luxexcel booth was given over to displays highlighting the future applications of the technology that are in development.

'We can print anything you like on the lens to personalise it – names, pictures or logos,' says Groet. 'Something that works well, we think, is to print a child's favourite sports figure onto the lens to help them get used to wearing glasses. They can pick their favourite image and supply it digitally. We've integrated sensors into the lenses, which can monitor things like blinking and sound an alarm for drivers falling asleep at the wheel.'

Many frame companies at the tradeshow expressed interest in the design possibilities offered by 3D printed lenses. 'We can integrate the frame and achieve new designs,' says Groet. 'Also fully 3D printed glasses [frame and lenses] are easy to achieve now and have appeal too.

Luxexcel also demonstrated applications in active tint control and electrochromic functions along with safety goggle lenses and tints.

'For tinting we have integrated a film inside of the lens, which can be any colour you like. In a conventional lab the tinting process is complicated and not always consistent whereas we industrialise it so you can achieve the shade and gradient you want and replicate it in the future,' he says.

As with any potentially disruptive technology assessing what the future holds for the Luxexcel platform and its impact on the lens sector are difficult to assess.

However, a new method producing the sort of specialist lenses outlined above is likely to be most welcome at a time when the skills required to manufacture such products traditionally are declining.

Many practice owners who visited Luxexcel in New York asked about the possibility of the machine being available for practice labs.

'A lot of the practice owners we have spoken with really like what we do,' says Groet. 'We will keep them informed on which labs will be offering it. The practice owners want to know if it is small enough to put in their own lab but that is not our goal at the moment. For now the machines are quite sizeable and you need the coating facility too. Maybe in 10 years things will have changed on this matter.'

The company has been recently boosted by $10 million of equity financing from a group of financial and strategic investors.

'It is an exciting time because we have been in the market for several years working on our platform but only now are we putting our heads above the water,' says Groet. 'People are amazed it is possible, every lab representative at the show has stopped by. The response has been amazing because this is real innovation.'