

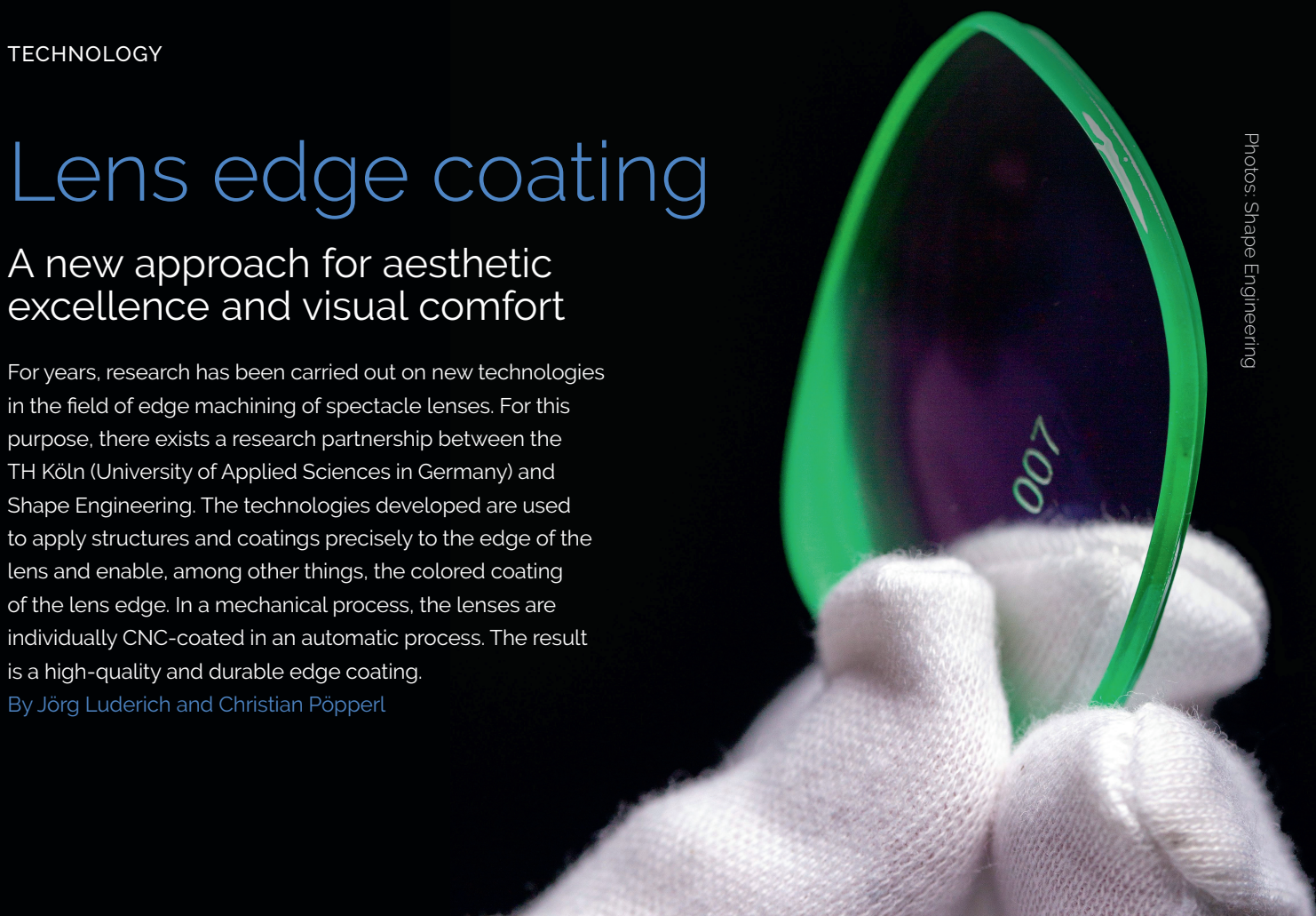
Lens edge coating

A new approach for aesthetic excellence and visual comfort

For years, research has been carried out on new technologies in the field of edge machining of spectacle lenses. For this purpose, there exists a research partnership between the TH Köln (University of Applied Sciences in Germany) and Shape Engineering. The technologies developed are used to apply structures and coatings precisely to the edge of the lens and enable, among other things, the colored coating of the lens edge. In a mechanical process, the lenses are individually CNC-coated in an automatic process. The result is a high-quality and durable edge coating.

By Jörg Luderich and Christian Pöpperl

Photos: Shape Engineering



This article provides an insight into the motivation and the new possibilities for improving vision and appearance through tinted lens edge coatings. For the time being, the focus will be less on technological aspects and more on the benefits to the spectacle wearer.

Influence of the edge of the lens on vision and appearance

While the lens is responsible for “vision”, the “appearance” is determined by the frame. However, there is another factor that has a major impact on the appearance and effect of the glasses: the edge of the lens.

Figure 2 shows two optical phenomena that are always present and have a detrimental effect on the overall impression of the spectacles and the spectacle wearer, due to reflections at the edge of the lens. The power of the lens leads to myopic rings in short-sighted people, which are more or less visible to the observer depending on the lens power, frame size and viewing angle. While myopic rings can only be seen at a flat viewing angle at lower diopters (see Fig. 2 on the left), at higher diopters, the rings are also visible from the front and can have a significant impact on the aesthetic appearance.

We would also like to address the second effect here, namely the white reflections between the frame and lens – known as “white rings” – which can also occur with plus lenses. Caused by the diffuse reflective surface of the edge of the lens, they show up more or less strongly depending on

the lighting conditions, making the otherwise transparent lens visible to the observer. For some people from outside the industry who are interested in aesthetics, this makes the edge of the lens appear rough or poorly finished – in contrast to the optically perfect surface of the lens and the high surface quality of the frame.

Both phenomena are of course known to every optician and many spectacle wearers and are accepted as inevitable – “it has always been that way”.

Edge coating opens up many possibilities – from “invisible” to “fashionably individualized”

The new coating technology (shape-line) now makes it possible to modify the color of the reflections that inevitably occur at the edge of the lens towards the frame, depending on the lens power, and thus greatly improve the aesthetics; especially in the case of short-sightedness (Fig. 3). The edge-coated lens blends harmoniously into the overall appearance of the spectacles. It becomes almost invisible and – depending on the viewing angle – can only be perceived by the colored residual reflections of the anti-reflective coating. In order to achieve this effect in as many frames as possible, five coating colors are currently used – black, grey, blue, brown and gold – which are combined in the “classic line” color palette.

Another way to reduce the unaesthetic reflections on the edge of the frame, thereby offering the customer improved aesthetics and greater perfection, is to use skin tone-like colors. Based on colors often used in

cosmetics, the aim is to achieve harmony between the skin color and the reflections from the edge of the lens, thereby to create a harmonious overall impression thanks to the reduced contrast.

The color palette is complemented by the five bold colors of the “splash line” which can be used by fashion-conscious spectacle wearers to express their preferences. If the color is chosen to contrast with the frame color, the edge of the lens can be fashionably accentuated – the glasses can thus be individually adapted to the wishes of the wearer (Fig. 4). Glasses are created in which not only the lens and frame have a perfect finish, but also the transition between the two – the edge of the lens – is perfectly designed.

High-tech made in Cologne

In total for the market launch, shape-line is being offered in 15 colors in 3 lines. To ensure the highest level of quality for this special area of application, not only the development of the application technology but also the development of the coatings is carried out internally at Shape Engineering in Cologne. On the one hand, this allows us to react quickly to customer demand and optimize or expand the color range. On the other hand, the coatings can thereby be better designed and thoroughly tested to suit the typical requirements of the industry. The coatings are available for all common lens materials with refractive indices from 1.5 to 1.74. They are tested for their resistance to UV radiation, cleaning agents and sunscreen, among other things. The color of the coatings is stable over the long term and remains unchanged over the service life of the glasses.

The coating is applied via an automated process in which the material is applied very precisely to the edge. It is not necessary to mask off the edge beforehand or wipe off any excess afterwards. The lens itself is machined in the usual way, based on a few instructions, and then sent in for coating. There is no need for the optician to purchase his own equipment or additional aids.

The edge thickness determines the effectiveness

The effect of the edge coating obviously depends on the edge thickness of the lenses. With normal edge thicknesses, very good results are achieved with minus lenses with a suitable choice of refractive index up to approx. -6 dpt. (Fig. 3 and 4). Even a moderate protrusion of the rear edge of the lens is generally unproblematic. If the edge of the lens is particularly thick, due to the choice of an inexpensive lens (e.g. $n=1.5$) or a large frame, it is advisable to choose a contrasting coating from the “cosmetic line” or “splash line”. Otherwise the colors selected to match the frame may appear too dominant.

Even when the thickness of the edge increases due to high correction values, the deliberate choice of contrasting colors is a good way to achieve aesthetically pleasing designs. Fig. 5 shows spectacles with -13/-16dpt – with and without coating. While the thick lens rims do not become “invisible”, the result is a design that pleases customers.

Coating offers another advantage for these high lens thicknesses. The interference of light from outside via the clearly protruding rear edge of



Fig. 2: Myopic rings and “white rings” affect the overall appearance of the spectacles. Example glasses with -4dpt lenses.



Fig. 3: With edge coating, bright reflective and myopic rings can be made to “disappear” by choosing a suitable color. The lens becomes almost “invisible” and a harmonious overall appearance of the spectacles is created. Example glasses with -2 dpt.



Fig. 4: For the fashion-conscious: customers can choose their desired color from “high-contrast” to “discreet”.

the lens is blocked by the coating. The diffuse light that normally occurs in this area is eliminated and customers describe their vision as much more relaxed, especially at work or driving.

Eliminating diffuse light for optimum visual comfort

This effect is observed even more strongly by spectacle wearers with black edge coatings (Fig. 3). Black edge coatings absorb all diffuse light emanating from the edge and, in combination with a high-quality, anti-reflective coating, provide optimal visual comfort, e.g. when driving. All 12 of the people fitted with black edge-coated lenses (range -2 to -6.25 dpt) as part of the practical long-term test reported significantly better vision, particularly at work, when driving after work, watching TV, at the cinema and in general.

They particularly noticed this in comparison to their previous glasses: suddenly they could see reflections they had never noticed before. The repurchase rate is 100%.



Fig. 5: Even with high lens thicknesses, designs can be found that appeal to customers

Glasses with
+13 / -16 dpt
coated with
"honey gold"

Fig. 6: Progressive spectacles with +1.25 dpt. The edge coating chosen to match the temple color subtly perfects the aesthetics of the glasses.



Fig. 7: A high-quality box with up to 15 sample lenses and two sample frames is available to assist with advice and sales.

It is no exaggeration to state that dark, highly absorbent edge coatings should be recommended as standard for high visual comfort requirements. They not only block the light hitting the edge of the lens from the outside, but also eliminate all internal reflections through absorption. This is something that has long been known in the field of precision optics. For example, all optical edges of high-quality lenses are always blackened. The same potential for improved vision can now also be exploited for ophthalmic optics.

As can be concluded from the above, this innovative technology opens up completely new possibilities for short-sighted spectacle wearers while at the same time the overall appearance of the glasses can also be optimized with plus lenses. Fig. 6 shows a pair of low-vision varifocals (+1/+1.25dpt) with "splash green" coated lens edges to match the side color. The colored lens edges, which appear discreet due to the low edge thickness, give the glasses an interesting, particularly high-quality appearance.

Getting to know and using the new technology

Participating opticians are provided with a high-quality box containing up to 15 sample lenses in different colors (Fig. 7), divided into the "classic", "cosmetic" and "splash" lines and supplemented with two optician-specific sample frames. The new options can be visually presented to customers and their questions answered. If the sample frames are provided with a coated lens on one side and an uncoated lens on the other, the advantages can be easily demonstrated and understood by any layperson.

As the technology presented here is a genuine innovation, it is also uncharted territory for all eyecare professionals and many questions will arise. The authors will be happy to answer them directly – just get in touch. The upcoming Opti will be a perfect opportunity to see the newly developed edge coating at first hand and talk to the developers about the possibilities and potential. ♦



Prof. Dr. Jörg Luderich

Prof. Dr. Jörg Luderich is the Head of the Product Development Laboratory and the MakerSpace at the University of Applied Sciences in Cologne. Based on 35 years of experience in the optical industry, he researches production systems for the adaptive manufacture of customized products. One of his main focuses is on additive and unconventional coating processes. joerg.luderich@th-koeln.de



Christian Pöpperl

Christian Pöpperl is a mechanical engineer and Managing Director of Shape Engineering GmbH. He has worked in the ophthalmic industry for 15 years and together with his team has successfully developed production systems and process technology for a wide range of applications since 2017. With shape-line, the market launch of the first in-house product for a wide audience is under way. poepperl@shape-engineering.de