Coated myriameter stone

Fully organic spectacle lenses: organic lenses now and in the future – SEIKO ORGATECH

What is the link between an archaic milestone and organic high-tech spectacle lenses?
Can such 'stones' and, in the wider sense, mineral components be amalgamated with organic compounds?
What have current production technologies to offer in the field of coated organic lenses?
It has always been our declared objective to develop an exclusively organic lens in order to do away with the negative effects of the material mix used for coating so far. With its new approach to organic coating SEIKO ORGATECH has taken on a role as trailblazer.

Since the introduction of the CR-39 organic lenses and since the application of the first coating 30 years ago, new products and technological approaches have emerged. In particular with regard to coated organic lenses and their finishing process one question arises: in how far can they be treated with non-organic components, i.e. with mineral and metallic components?
Now SEIKO ORGATECH is the trailblazing option.

Permanently coated milestone

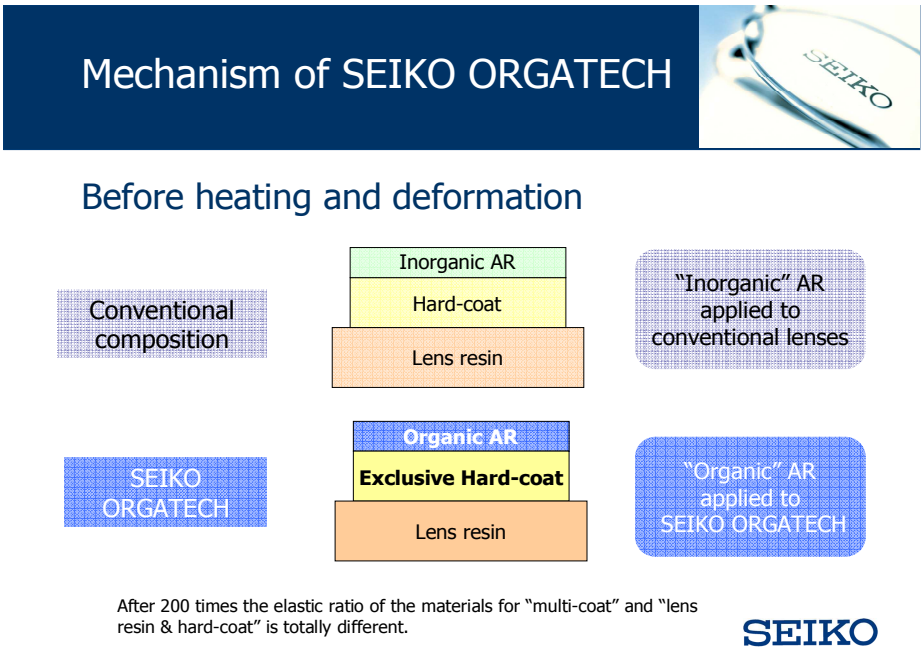
Expectations, names and status quo

One apparent market trend has long since become reality. Organic lenses are irrevocably established in the market and, in addition, they have more than one solid feature: based on all relevant statistics organic lens materials have the highest market share. With about 75% they are in a leading position. The almost equally big share of coated lenses cannot be ignored either.
What the consumer expects is light, thin, flat and good-looking lenses that make vision clear. The optician expects that the lenses are made of high-quality materials, that they are designed perfectly and that they are optically flawless.

Technology is the connecting link between those expectations by offering and adjusting different components and manufacturing methods.
Considering the argument of high prices coming up from time to time, it is vital to be aware of the importance of the price-benefit ratio. It is increasingly important to put the emphasis on customer benefit, particularly regarding the rise of the value added tax in Germany.
The brand name SEIKO, which also the consumer is familiar with, definitely helps to get the message across and to meet the expectations.

Over and over again new high-quality optical innovations have been launched that have become the standard of lens technology after some years. Considering the great variety of new products, even opticians find it hard to spot leading developments that would meet his customers' expectations. As an example for landmark products I would like to mention internal progression with free-form surfacing for progressive lenses introduced about 10 years ago, photochromism on 1.67 introduced more than half a decade ago and last of all the introduction of the organic material ULTRA-HIGH 1.74 in 2001 - all of which were launched by SEIKO.
The discrepancy between the expectations and the latest developments in technology can be explained with the help of material 1.74 mentioned above. Ideally, the index of

the hard-coat corresponds with the index of the organic lens material. This could not be the case in the beginning as there were no hard-coats with such a high index and interferences were noticeable. It was only after other manufacturers had launched ULTRA-HIGH, too, that inquiries from opticians and consumers were decreasing as their products showed the same characteristic.
Almost every new type of product featuring an unknown technology faces a similar fate when it comes on the market. The customers' questions have a positive effect: they prove that they have gone into the subject and they trigger off good ideas for useful and quick developments. Our customers agree that this is true; all the more reason to do so.
The latest developments in coating technology are as follows: with the properties of the special SEIKO HIP-Coat and thanks to an extremely thin coat, the ULTRA-HIGH 1.74 organic lenses stand the falling-ball test even with low thicknesses. (Transparency 1)



Transparency 1

Since the beginning of Seiko's worldwide introduction of HIGH Index 1.60 and SUPER-HIGH Index 1.67 over 10 years ago, the resistance of coats and the suitable terms describing their properties is *the* big question occupying opticians. Sometimes the word

'scratchproof' is still being used. Everyone knows that it does not stand for complete scratch resistance. Many consumers generalise the word 'hardness' deriving from hard-coat thinking that the entire lens is hard, even if this is only true for the coat and not for the lens resin. When talking about the organic lenses' surface robustness, the terms 'longevity' and 'stability' are more suitable. Manufacturers and opticians remain uncertain whether a top product will later be treated appropriately.
Would it not be desirable to have a product that comes up to the customers' expectations as closely as possible?

Different methods and qualities

While in the beginning the stability and even the adhesion of the hard-coat on lens surfaces was questionable, manufacturers now busy themselves with the relativity of test methods. In this context *the* big question is what is tested and how, and what limits are convincing?
It is obvious that one single test method does not reflect a full range of realistic conditions or everyday suitability. This is why there are several surface test methods. Their criteria are helpful for a comparison of qualities. The requirements as to chemical resistance (cosmetic products, UV radiation and weather) are easier to fulfil than those regarding the mechanical resistance (adhesion and abrasions strength).

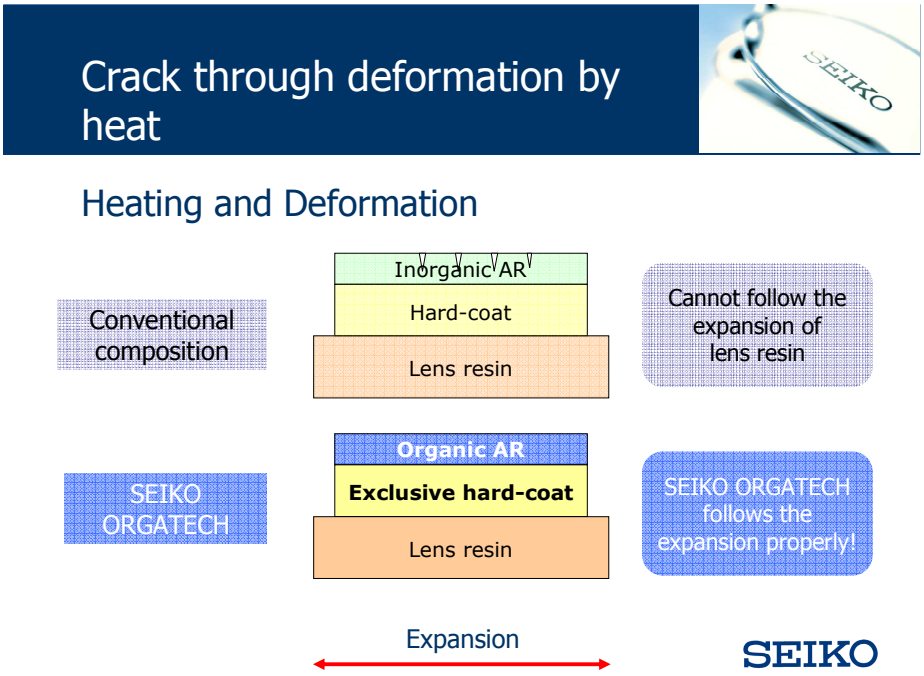
In order to meet the expectations and requirements, production processes are being developed further, while the customers are given expert advice.
For 20 years now it has been a target to develop the resistance of coats on organic lenses by selecting the most appropriate components. After having reduced reflection, the abrasion strength was improved through the mineral component silicon dioxide. This vacuum evaporation process, however, leads to considerable brittleness due to the layer thickness, and it might even destroy the base material through tension.
Chemical processes generate a so-called plasma environment, into which a gas mixture and electricity are fed. That way the

disadvantages of mineral quartz hard-coats are almost completely excluded provided that the parameters are set appropriately (for example the pressure range).

For 10 years wet chemical processes have been in use besides "dry" vacuum evaporation. During the wet process the organic lenses are coated with liquid coats and the high vacuum becomes superfluous. The polysiloxane coats are applied in a dipping or spinning process. Then they are left to harden at three-figure temperatures. The chemical industry provides various additives for hard-coats. The special trick is to stick to the optimum process parameters and to use the most suitable coat.
This procedure leads to an improved viscoelasticity of the layers. A coat developed from silanes through hydrolysis and condensation is then applied to the lens. Due to the inclusion of a hydrocarbon chain and under heat addition the organic molecule groups combine with the organic lens and, besides improved adhesion, abrasion strength is increased by far, as the quartz layers are hardly brittle any more.
Especially for high-index lenses nanocomposite coats with additional particles are used to achieve further improvements. These tiny mineral particles add to the abrasion strength and consequently to the layer hardness.

Fully organic lenses thanks to SEIKO ORGATECH

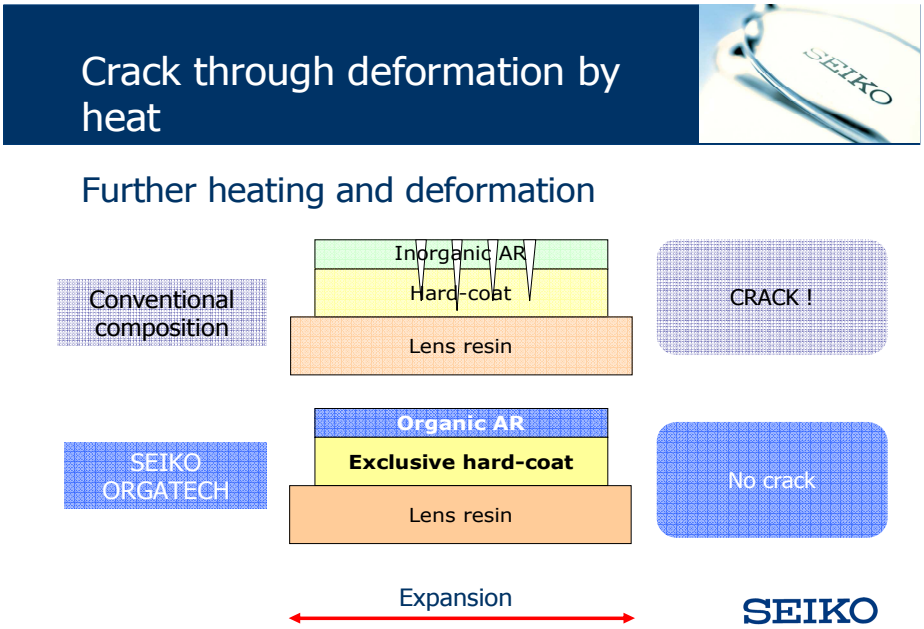
At this point the basic question of how to combine mineral and organic components and properties comes up again. (Transparency 2)



Transparency 2

Thermal expansion coefficients differ largely, so that mechanical tensions can lead to cracks. The risk of cracking can increase depending on lens shapes, sizes and thicknesses as well as on the conditions of lens treatment.

Based on the above example of interferences, high-index materials must be carefully adapted to all high-index lenses. Inorganic metal oxides in the hard-coat can have a negative impact on the organic lens resin, even if this is the latest development in technology.



Transparency 3

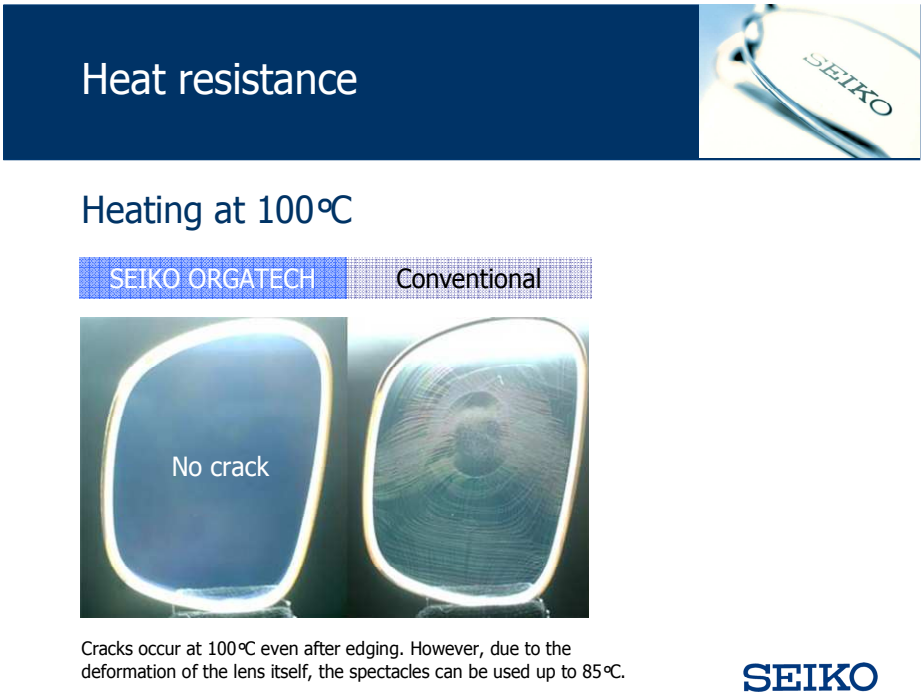
With coated lenses this whole issue also concerns the other layers applied, such as multilayer anti-reflection coatings and oliophobic and hydrophobic SuperCleanCoats. (Transparency 3)

The main reason for criticism lies in the sequence of the components used for coating. Good results are obtained if identical properties are combined, i.e. inorganic with inorganic and organic with organic.
Up to now a technology is used that serves as a buffer between the organic resin (organic spectacle lenses) and the inorganic anti-reflection layers and that is adapted to both properties. A literally fully organic lens would be most welcome.

SEIKO ORGATECH: technologies compared

Thanks to SEIKO ORGATECH a new quality standard has been reached worldwide. Due to extensive experience in technology and manufacturing, a new chapter of organic lens development and production has been opened up.
For the first time the approach to organic lenses is all-embracing. Regarding super anti-reflection coatings the ideal adjustment of exclusively organic components leads to a new, more bluish and attractive tint. The

quality of hard-coat and SuperCleanCoat has also been developed further. Resistance against heat, shock, pressure and scratch is now many times better.



Transparency 4

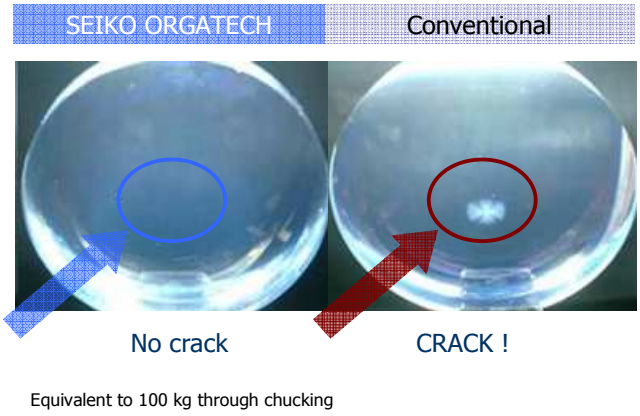
The new development shows remarkable properties regarding temperature (warming up & heat) in an uncut and edged state. Under the influence of temperature the expansion coefficient between an anti-reflection coating and the combination of an organic resin and a hard-coat can differ by an approximate factor of 200.
On uncut lenses the completely organic coat described above remains intact under temperatures of up to approx. 120°C. It is true that this value is reduced under edging conditions, but layers are damaged only at about 100°C or more. Mind you, we are talking about fully organic qualities, i.e. the organic coat is also resistant to deformation. The influence of temperature would, however, lead to a change in lens powers. So the lenses would be of no use to the wearer.

Pressure test

Equal to 100 kg in edgers

SEIKO

Anti-deformation



Equivalent to 100 kg through chucking

SEIKO

Transparency 5 & 6

When the lenses are deformed mechanically (tension), they show remarkable resistance, and damage is rare. This is not just an advantage for the wearer, but it also facilitates the preceding edging process. Pressures that are equivalent to the clamping pressure of up to 100 kg in edgers do not cause any problem. There are not any more tension cracks. (Transparency 5 & 6)

Thanks to SEIKO ORGATECH the attractive organic SUPER-HIGH 1.67 lenses, which are not made from polycarbonate (impact-resistant thermoplastic resin) can now stand the falling-ball test, too.

Scratch resistance

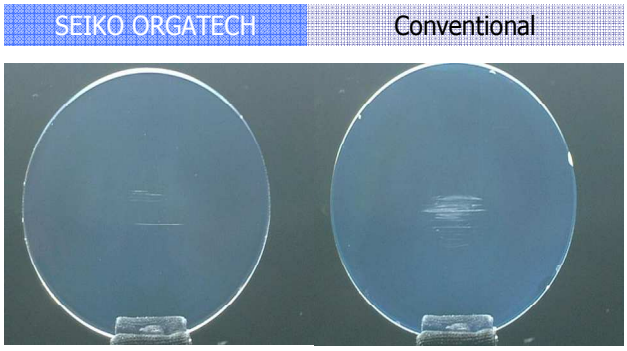
Equal or greater as conventional HMC

SEIKO ORGATECH

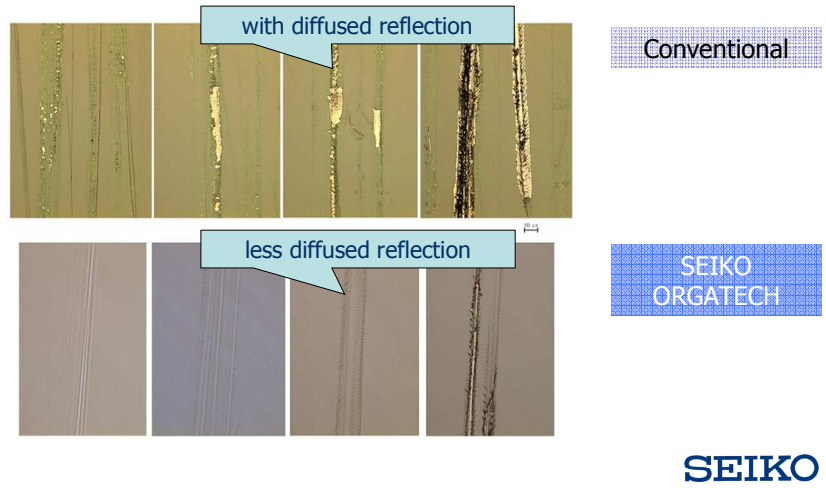
SEIKO

Transparency 7

The scratch resistance quality has also been improved. The lenses are less sensitive and the coating is more resistant (tested with a wire brush under a pressure of 1 kg). Consequently the lenses have an increased longevity. Scratches do not look as bad as before, as the organic coating is more elastic now. As there are fewer scratches on the surface, there are fewer diffuse reflections and there is less scattered light. (Transparency 8 & 9)



Transparency 8



Transparency 9

The future with SEIKO ORGATECH

Under usual conditions the so-called resistance is practically oriented.
The resistance of SEIKO ORGATECH lenses against heat, dirt or cleaning has reached the highest level ever achieved. This is all the more true in combination with the most

resistant and elastic thermosetting hard resin in 1.67 SUPER-HIGH. Moreover, Seiko was able to eliminate basic technological problems in coating and can now come up to its customers' expectations even better.
This new fully organic technology gives the optician the last bit of missing safety in the treatment of high-quality lenses. It is now less critical if edgers operate with too high a pressure. And it is no longer risky to warm up fashionable plastic frames for the glazing of organic lenses. Unintentional damage, such as scratches occurring during the glazing process is nearly impossible. Consequently, it is less probable that customers will complain about their glasses.
Applying improved high-tech processes means a greater benefit for the wearer. Of course, the product price is higher and so is possibly the margin. One example of the continuously improved quality is the SuperCleanCoat, which is a standard on all SEIKO spectacle lenses instead of a mere CleanCoat.

For the customer this new fully organic technology means the last bit of quality that he has possibly missed. The new organic SEIKO ORGATECH lenses clearly offer more comfort and a higher resistance against dust and dirt. They are also more resistant to high temperatures, so they are easier to use when riding a car in the summer, for example. While normally coated lenses can resist temperatures of about 60°C many times without being damaged, SEIKO ORGATECH lenses can withstand temperatures of up to 85°C without a problem. During the hot summer months temperatures inside a car can rise to 70 or 80°C, so the new and all-embracing approach to light, coated organic lenses offers a solution to these conditions.

This is a distinctive feature when comparing a high-quality branded lens with a cheap no-name product. Customers are liable to have more confidence in the branded product and the competent optician. SEIKO has set yet another milestone. It will establish in the optical sector to become a standard. The new organic technology SEIKO ORGATECH will last, but not least, increase the success and satisfaction of all persons involved.

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