Fun Facts on ZEISS Lens Coatings

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Since when have eyeglass lenses been coated, and why?	The technique used to produce antireflective lens coatings that forms the basis of the methods used today was patented for ZEISS as long ago as 1936. It was not until 1959 that antireflective coatings were used for eyeglass lenses. Before this, these coatings were primarily used for binoculars. ZEISS was the first manufacturer to offer antireflective coatings for eyeglass lenses.
Out of the blue	The residual reflection color is the property that distinguishes one antireflective coating from another. Every antireflective coating from ZEISS has a characteristic color, regardless of the material of the base lens. The general rule is: the more compact the coating, and therefore the higher its quality, the bluer the residual reflection becomes. For the high-quality coatings of the ZEISS DuraVision Premium category, a bluish tinge remains on the lens.
Lenses from outer space?	We use the term "vacuum" to describe a space that is devoid of air and therefore also largely free from particles. The vacuum in space is more perfect that any vacuum generated on the Earth – here there is only one particle per cm^3. As particles in the air prevent the error-free application of lens coatings, high or ultrahigh vacuum conditions are used. It is not possible to create conditions such as those encountered in space, but pressure and particle reduction guarantee that the coating is correctly applied.
Is this just splitting hairs? How thick is a coating?	Only a thick shell can possibly protect the lens against damage – at least that's what our logic tells us. In other words, hard coatings on lenses would have to be really thick and robust to protect the underlying sensitive plastic material. The exact

	opposite is in fact the case. A hard coating applied by ZEISS displays an average thickness of just 2 µm (0.002 mm), but protects the lens reliably against scratches and damage. To put that in perspective, a human hair is around 0.05 millimeters thick.
Why do you bombard eyeglass lenses at ZEISS?	To guarantee the hardness of vacuum-deposited coatings, a process known as ion implantation is used. In other words, the lens surface is bombarded with accelerated foreign atoms (ions). When they impact the lens surface, the ions transfer their kinetic energy to the coating molecules. The result: The coatings display greater density, considerably increasing their hardness and scratch resistance.
What do Asian flowers and ZEISS eyeglass lenses have in common?	The Asian lotus flower is well-known for its water-repellent (hydrophobic) properties. The hydrophobic properties of surfaces is determined by what is known as the contact angle. The higher the contact angle, the more hydrophobic the surface becomes. Thanks to their dual structure, lotus leaves have a contact angle of around 170°, with a water droplet having a contact surface of about 0.6 percent. This means that the contact surface between the leaf surface and the droplet is so small that the water can easily bead off. Lenses coated with ZEISS DuraVision have a contact angle of more than 110°. Therefore, they come very close to the lotus leaf and hence also exhibit an excellent beading effect.
Why coated lenses have to survive a shave	Coated lenses have to stand up to a large number of quality tests before they are released for the harsh conditions of everyday use. One of these is the cross hatch test. Here a razor-blade is used to cut a grid-like pattern into the coating down to the base lens. An adhesive tape is then repeatedly applied to and stripped off the treated lenses in several cycles. This method is used to determine

	whether even the slightest detachment occurs due to the destruction of the surface.
Faster than Formula 1?	During the vacuum deposition of the antireflective coating, small quantities of the coating material, which is inserted in ceramic or water-cooled metal crucibles, is heated with the aid of accelerated electrons. Here the material is transferred from a solid to a gaseous state. The gas molecules leave the surface of the antireflective material at a speed of around 100 m/s, the equivalent of approximately 360 km/h, and are deposited on the surface. Comparison: the fastest serve ever measured during a tennis tournament was 263 km/h, and the highest speed ever recorded in Formula 1 racing was 369 km/h – just 9 km/h more.
What does ET, the extraterrestrial, have to do with the coating of lenses?	You may have seen the abbreviation in connection with ZEISS lenses. This has nothing to do with extraterrestrials, we assure you! Its top-of-the-line version is called SET – Super ET – in short. Strangely enough, "ET" is not the abbreviation of the German word for antireflective coating, but stands for "simple camouflage coating" ("Einfache Tarnschicht"). Originally, the coating was used not for eyeglass lenses, but for binoculars. During the war it would have been very dangerous for the soldiers if the lenses of their binoculars had reflected light and revealed their position to the enemy. The antireflective coating was invented to prevent this happening.

Press contact
Vision Care
Joachim Kuss
Phone +49 151 42112288
E-Mail: joachim.kuss@zeiss.com

www.zeiss.com/press

www.zeiss.com/vision > Newsroom

ZEISS
ZEISS is an internationally leading technology enterprise operating in the optics and optoelectronics industries. ZEISS develops and distributes lithography optics, measuring technology, microscopes, medical technology, eyeglass lenses, camera and cine lenses, binoculars and planetarium technology. With its solutions, the company constantly advances the world of optics and helps shape technological progress. The company is divided up into the six business groups Industrial Metrology, Microscopy, Medical Technology, Vision Care, Consumer Optics and Semiconductor Manufacturing Technology. ZEISS is represented in over 40 countries – with around 30 production sites, over 50 sales and service locations and about 25 research and development facilities. In fiscal year 2013/14 the company generated revenue approximating 4.3 billion euros with just under 25,000 employees. Founded in 1846 in Jena, the company is headquartered in Oberkochen, Germany. Carl Zeiss AG is the strategic management holding company that manages the ZEISS Group. The company is wholly owned by the Carl Zeiss Stiftung (Carl Zeiss Foundation). Further information at www.zeiss.com

Vision Care
As one of the world's leading manufacturers, the Vision Care business group combines ophthalmic expertise and solutions with an international brand. The business group develops and produces instruments and offerings for the entire eyeglass value chain. In fiscal year 2013/14 the business group generated revenue of 761 million euros with around 8,300 employees.