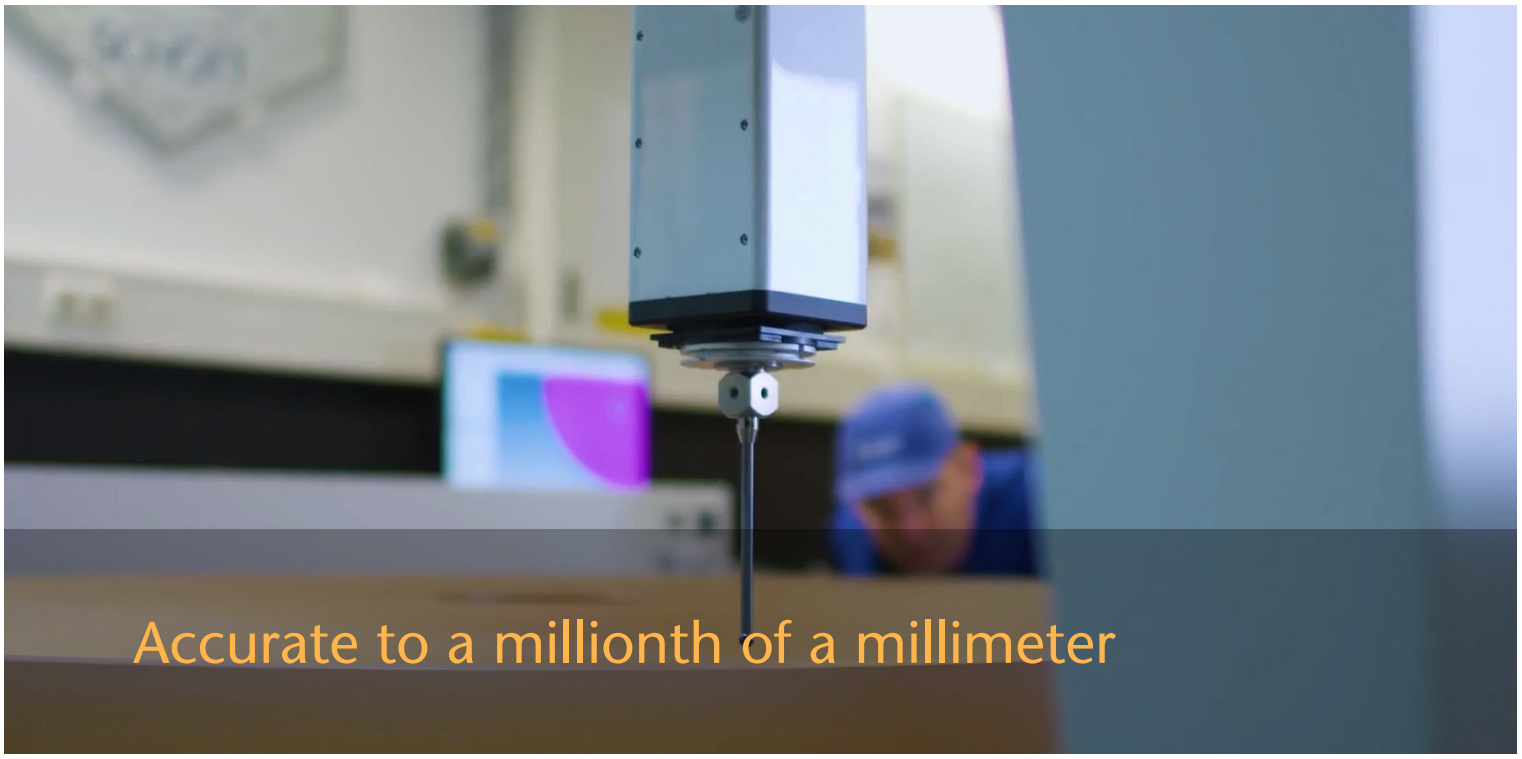


Accurate to a millionth of a millimeter

Researchers and developers are constantly working to the limits of what is technically feasible to come up with new findings and products, whether in search of new planets, in forecasting the weather or developing turbo-fast chips and flexible displays. Precision down to a millionth of a millimeter is indispensable to their efforts. It makes special glass-ceramic possible – and ensures that innovative ideas become reality.

Challenge

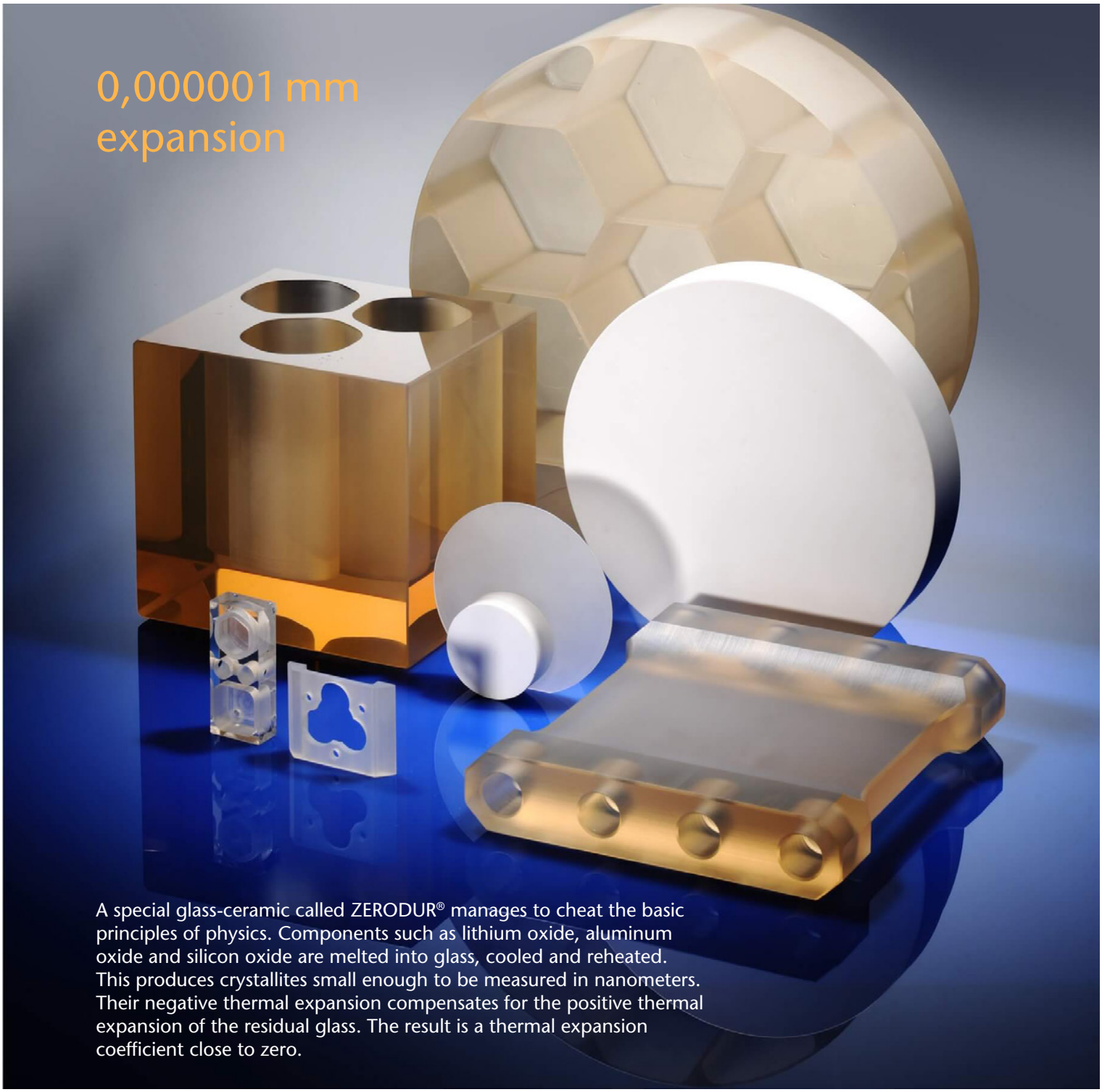
Growing with heat

Almost all materials expand with heat and shrink with cold. This is caused by thermal expansion behavior, the oscillation of individual molecules and atoms. Iron is a particularly clear example:

the Eiffel Tower is up to 30 centimeters taller in the summer than in the winter.

When it comes to high-tech products, however, materials should generally be resistant to temperature changes.

Cheating nature



A special glass-ceramic called ZERODUR® manages to cheat the basic principles of physics. Components such as lithium oxide, aluminum oxide and silicon oxide are melted into glass, cooled and reheated. This produces crystallites small enough to be measured in nanometers. Their negative thermal expansion compensates for the positive thermal expansion of the residual glass. The result is a thermal expansion coefficient close to zero.

“ZERO” and “DUR” as quality features

Whether hot or cold, ZERODUR® shows “zero” influence, even under extreme pressure. The name also stands for durability. It’s good machinability and excellent homogeneity properties offers even more advantages. Developed 50 years ago, it is now more in demand than ever for a variety of technical applications that all have one thing in common: precision.

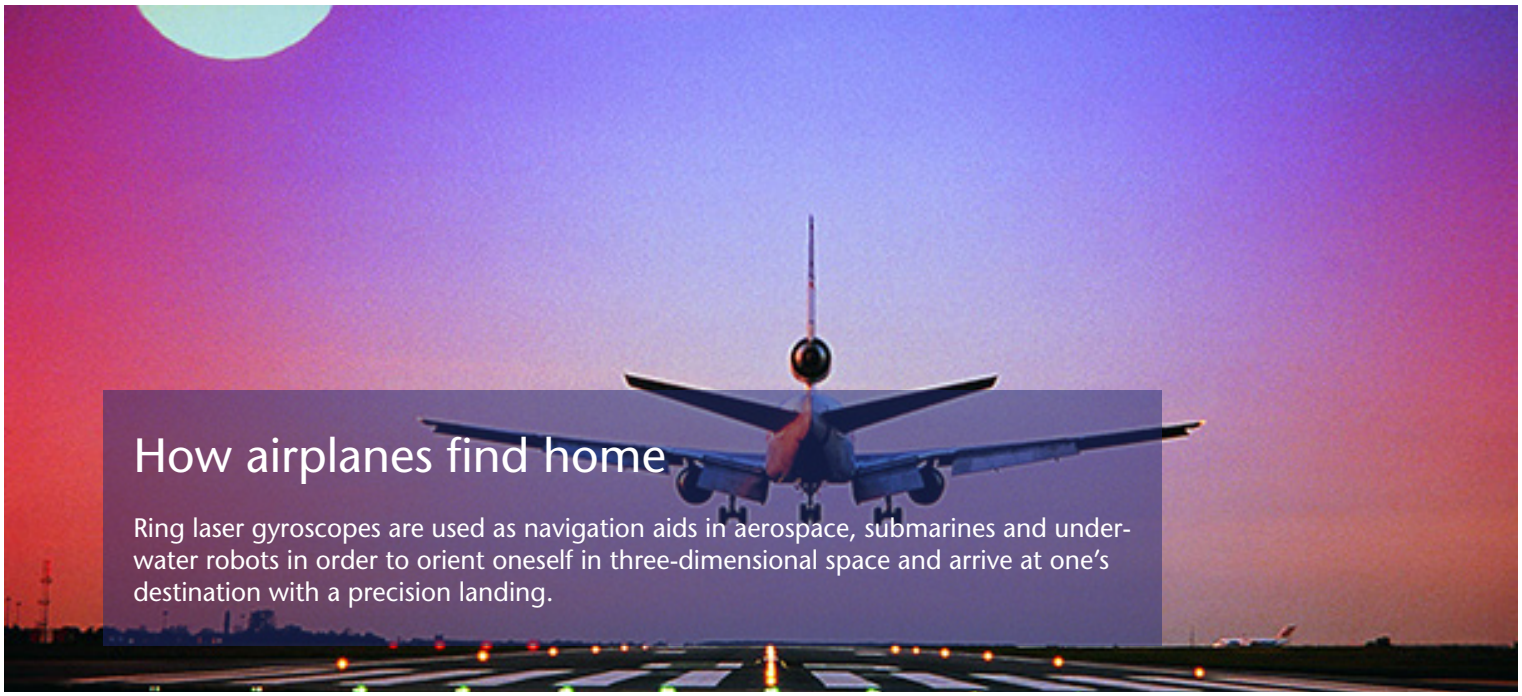
ZERODUR® – an all-round talent in use

Wonder material for long vision

On Earth or in space: telescopes capture light that has been on the move for billions of years. Even the slightest change in the mirror surface – due for instance to temperature changes – would have a negative effect on image quality. Every mirror substrate – such as those nearly 800 of the Extremely Large Telescope – must therefore be a work of precision in order to fulfill its mission: sharp images from distant galaxies and an explanation for mysterious dark matter.

Mirror substrate on slimming tour

Satellites orbiting the Earth as well as space telescopes must be as light as possible. Every gram counts. This is why special lightweight mirrors are used in their optical systems. A triangle isogrid or honeycomb structure on its back can reduce its weight by up to 85 percent.



How airplanes find home

Ring laser gyroscopes are used as navigation aids in aerospace, submarines and underwater robots in order to orient oneself in three-dimensional space and arrive at one's destination with a precision landing.

Forecasting the weather

You can't change the weather, as you know, but you can equip yourself well for it. Whether a holiday, a weekend trip or a bicycle tour, the weather forecast helps to decide whether or not to bring along your rain jacket. Weather satellites orbit the Earth at an altitude of about 36,000 kilometers, scanning the Earth's disk several times per minute in various spectral ranges. The more precise the instruments and components used, the better the prediction and more satisfied people are.

Super small but Wow!

Thanks to technological advances in microlithography and the highest precision in the positioning of photomask and wafer, it is possible to continuously reduce the structures of microchips. This brings not only a plus in performance, but also more cost-effective chip production. Be it for computers or smartphones.

Large, fast and super sharp

TV flat screens have not only grown in size in recent years, but also deliver higher resolution with more pixels and razor-sharp TV images. To produce the large-format screens, optical components such as prisms and round mirrors are used in the exposure devices, which weigh many tons. They enable the required high-precision light guidance when the filigree transistor structures are applied to the display glass. And all that in one operation.

"Without a material with these properties, a project like the Extremely Large Telescope would not be possible."

– Markus Kissler-Patig, Senior Astronomer at the ESO

"Together with our customers, we have continuously optimized ZERODUR® over the past 50 years."

– Thomas Werner, Project Manager ELT at SCHOTT

When precision and shifting technological boundaries are at stake, components made of ZERODUR® and the know-how of SCHOTT's glass experts make it possible – yesterday, today and especially tomorrow.

Let's continue our 50 years success story

What's your next milestone?

Dr. Thomas Westerhoff
Advanced Optics
SCHOTT AG

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