Fraunhofer

RESEARCH NEWS

Laser method opens up new opportunities in optics

Laser Technique Halts Potential Long-Term Consequences of Nearsightedness

Microlenses applied to eyeglasses can help reduce growth-related worsening of nearsightedness (myopia), preventing potential long-term consequences. Microlenses also offer highly promising possibilities for intraocular lenses or compact microscopes. The Fraunhofer Institute for Microstructure of Materials and Systems IMWS has developed a new method known as laser swelling that can be used to produce these kinds of lenses individually and at low cost.

Around the world, some 33 percent of children and youth over the age of five are nearsighted these days. Scientific studies predict that this figure could rise by about seven percentage points between now and 2050. And that means with increasing age, more than 740 million children could also suffer from the potential long-term consequences of nearsightedness: retinal detachment, cataracts or macular degeneration.

To go beyond merely correcting vision and also help slow or prevent the progression of nearsightedness and potential long-term consequences, microlenses are already in use in special eyeglasses for children. A superimposed focal point on the periphery allows them to slow the elongation of the eyeball that triggers the progression of myopia.

Laser swelling offers maximal flexibility

Researchers at Fraunhofer IMWS have devised a new method of producing microlenses individually and at lower cost. In laser swelling, a focused infrared laser is beamed at plastics used for eyeglasses. The laser, which functions as a local heat source, excites water molecules present inside the polymer. This causes the molecules to start to move, creating internal pressure that can only discharge upward. The process forms a little bump on the surface that remains after the laser treatment: a microlens or lenslet.

“The laser beam can be positioned with great accuracy on surfaces, so we can produce significantly smaller microlenses than is possible with previously existing methods,” explains Prof. Thomas Höche, the initiator of the technology and head of the Optical Materials and Technologies business unit at Fraunhofer IMWS. “And that means the microlenses can be arranged with great flexibility on eyeglasses, so they can be tailored individually to a wide range of use cases.”

Kontakt
Monika Landgraf | Fraunhofer-Gesellschaft, München | Kommunikation | Telefon +49 89 1205-1333 | presse@zv.fraunhofer.de
Michael Kraft | Fraunhofer Institute for Microstructure of Materials and Systems IMWS | Telefon +49 345 5589-212 | Walter-Hülse-Strasse 1 | 06120 Halle (Saale) | www.imws.fraunhofer.de/en.html | michael.kraft@imws.fraunhofer.de

In addition to individualization, laser swelling carries other crucial advantages in comparison to the injection molding method used to date. In this method, the polymer is pressed into a die made of glass or metal and subsequently released from the mold. This method is laborious and time-consuming, plus the tools need to be cleaned and replaced over time. By contrast, laser swelling does not require any tools. The process is entirely touchless. And since no material is removed, no microplastics are formed, either.

"Laser swelling also gives us a lot of flexibility in terms of the size and shape of the microlenses. From spherical to aspheric and even cylindrical lenses, anything is possible," Höche says.

Höche explains that laser swelling can be used in a wide range of fields, such as for creating microlenses on intraocular lenses, for microfluidic components, to improve the adhesive properties of polymer surfaces or for compact microscopes. The method could also be used to discreetly mark medical products such as syringes. Medications or vaccines could be given a code that contains a tracking number and is only visible with the right lighting, for example. The code could tell whether the product is genuine.

Höche and his team have applied for intellectual property rights worldwide and are currently working on the technology's commercialization process. They are still focusing primarily on the eyeglass market: "Corrective eyewear that can be tailored individually to the needs of certain occupational groups is our vision."

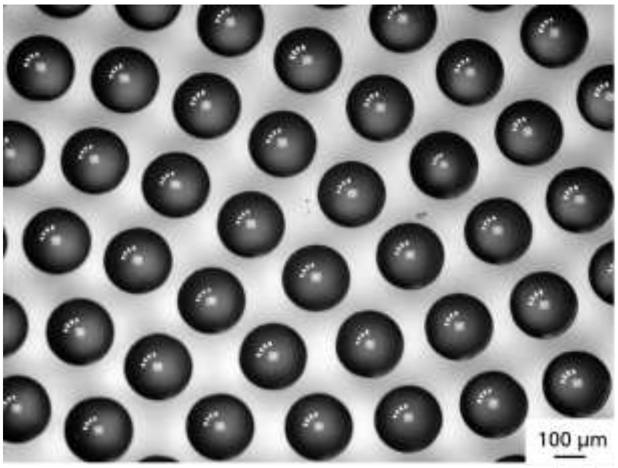

Fig. 1 The laser swelling method can be used to produce microlenses and arrange them with great flexibility on eyeglass polymers.