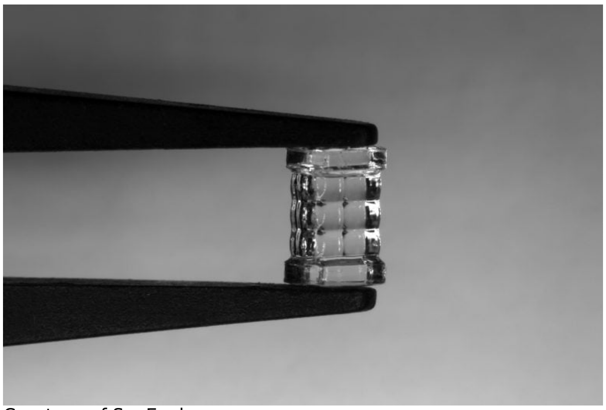
Using Blurred Light to 3D Print Superior Lenses

Posted by Okachinepa 05/09/2024



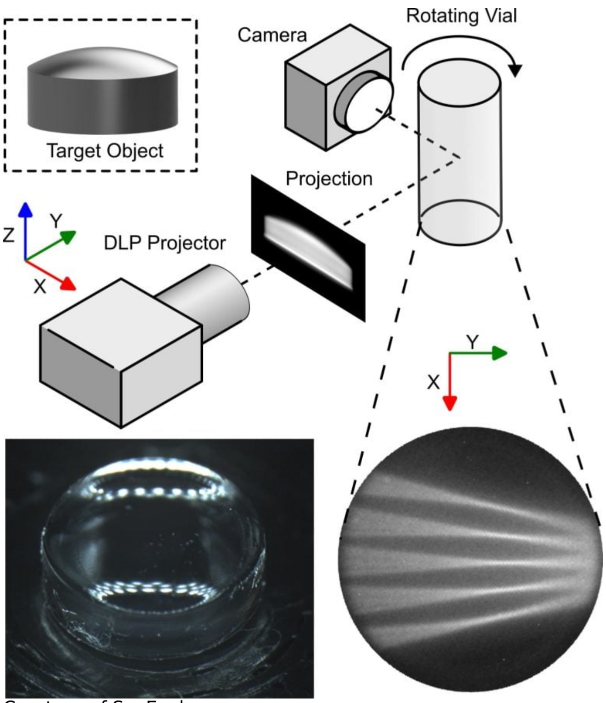
Courtesy of SynEvol
Credit: Daniel Webber, National Research Council of Canada

Blurred tomography is a new 3D printing technique developed by researchers in Canada that can quickly create microlenses with optical quality suitable for commercial use. The new process could facilitate the design and fabrication of a wide range of optical devices more quickly and easily.

Daniel Webber of the National Research Council of Canada stated, "We purposely added optical blurring to the beams of light used for this 3D printing method to manufacture precision optical components." The creation of optically smooth surfaces is made possible by this.

The innovative technology is demonstrated by these researchers by creating a millimeter-sized plano-convex optical lens with imaging performance comparable to a commercially available glass lens, which they publish in Optica, the journal for high-impact research published by Optica Publishing Group. They also demonstrate how the process can yield optical components that are operational in 30 minutes or less.

"We believe that this approach will be beneficial for quick and inexpensive optical component prototyping because of the tomographic 3D printer's low cost and the materials it uses," stated Webber. Additionally, optical designers may be able to simplify designs by substituting printed optics with complicated shapes for many standard optics due to the intrinsic freeform nature of tomographic 3D printing.



Courtesy of SynEvol
Credit: Daniel Webber, National Research Council of Canada

A relatively recent manufacturing technique called tomographic volumetric additive manufacturing employs projected light to solidify a light-sensitive resin in particular locations. It enables the simultaneous printing of a whole part without the need for support structures. However, because the pencil-like beams used in these tomographic technologies generate striations that result in minor ridges on the component's surface, they are unable to print imaging-quality lenses directly. While smooth surfaces can be achieved with post-processing stages, this approach is more time-consuming and complex, negating the benefit of rapid prototyping that comes with tomographic printing.

According to Dr. Webber, "the complicated and time-consuming manufacturing process, coupled with the strict technical specifications required for a functioning lens, make optical component fabrication costly." "Freeform designs can be produced at a reasonable cost using blurred tomography. New optical devices might be prototyped considerably more quickly as technology advances, which would be helpful for both commercial producers and do-it-yourself inventors.

In order to evaluate the new technique, the scientists first constructed a basic plano-convex lens and demonstrated that its imaging resolution was on par with that of a commercial glass lens of the same physical dimensions. In addition, it displayed a point spread function near the glass lens, sub-nanometer surface roughness, and form error on the micron scale.

Additionally, they used blurring tomography to create a 3x3 array of microlenses, which they then compared to an array created using traditional tomographic 3D printing. They discovered that because of the high surface roughness of the array printed using traditional methods, it was not able to image a business card; nevertheless, this could be accomplished with the array printed using blurred tomography. The researchers also showed how to overprint a ball lens onto an optical fiber, which was previously only achievable with the use of two-photon polymerization, an additive manufacturing method.

Currently, they are trying to increase component accuracy by integrating material characteristics into the printing process and refining the light patterning technique. Moreover, they wish to automate the printing time so that the system is reliable enough for business use.

According to Webber, "tomographic 3D printing is a rapidly developing field that is finding use in many application areas." Here, we create millimeter-sized optical components by utilizing the inherent benefits of this 3D printing technique. By doing this, we have contributed a quick and inexpensive substitute to the toolkit of optical manufacturing processes that may influence future innovations.

Currently, they are trying to increase component accuracy by integrating material characteristics into the printing process and refining the light patterning technique. Moreover, they wish to automate the printing time so that the system is reliable enough for business use.

According to Webber, "tomographic 3D printing is a rapidly developing field that is finding use in many application areas." Here, we create millimeter-sized optical components by utilizing the inherent benefits of this 3D printing technique. By doing this, we have contributed a quick and inexpensive substitute to the toolkit of optical manufacturing processes that may influence future innovations.