Wouldn’t it be exciting to sit in the midst of a film without wearing annoying 3D glasses? Not only for television fans, holographic displays would be a giant step in this direction. Medical scientists could inspect spatial images of the inside of the body and observe detailed movements of organs.

The company SeeReal Technologies in Dresden works on such displays. Holographic displays use certain properties of laser light for the complete three-dimensional display of images. Therefore, an expansion of the laser beam to the display size is necessary. One can easily imagine that a laser beam with a diameter of a television display is difficult to realize. A conventional option would be large lens systems, but these are clunky and can only be manufactured complexly and at very high costs.

In a joint project with SeeReal Technologies the scientists of Fraunhofer FEP have now developed coatings that enable usage of low power lasers for illumination. The laser is directed in at a very flat angle into a glass plate (here 5°, respectively 85° against the vertical). Similarly to the shadow of a person which is extending in the setting sun and whose projected area on the earth also extends, the diameter of the laser beam increases. A small spot becomes an elongated ellipse.

In a second step the elongated ellipse impinges again on a second glass plate at 5°, whereby the second direction of the ellipse, the “short axis”, is elongated. Thus the laser spot is expanded to a circle, that is large enough in order to illuminate the entire display. However, if you shine with a laser on an uncoated glass plate at such a flat angle, approx. 73% of the beam is reflected. In case of two “expansion steps” more than 90% of the original intensity would be lost!

“We have developed an anti-reflective coating which increases the part of the transmitted light significantly”, says Dr. Daniel Glöß, head of the “Dynamic coatings” department of the “Precision Coatings” division at FEP. “By means of magnetron sputtering, thin layers are deposited on glass. These layers consist of two different materials with...
varying optical density. Even complicated optical functions can be achieved via multi-
layer systems, which, for instance, let only certain colors of the light pass through and 
reflect the others.”

With its new precision coating plant PreSensLine, Fraunhofer FEP is optimally equipped 
for the high-precision coating of larger substrates. Thus functional panes of size DIN A3 
(approx. 300 × 400 mm² or 28” screen diagonal, respectively) have been coated with 
the special multilayer system. The specific challenge results from the combination of 
extreme requirements regarding the precision, reproducibility and homogeneity of the 
layers on this large area.

As in conventional color televisions, the color impression with holographic displays 
should result from a mixture of red, green and blue, whereby a white picture is created 
by overlapping. For this demonstrator 24 layers are required for the anti-reflective 
coating. The layer thickness of all 24 layers had to be hit correctly down to a few 
millions of millimeters (nanometers) and must also remain constant over the whole 
area. That is equivalent to only a few hundred atomic layers or in other words: Would 
you enlarge the coated plate to the size of a football field, the allowed tolerances of 
the individual layer thicknesses would correspond approx. to one-hundredth of the 
thickness of a human hair. Even slightly larger deviations lead to loss of the desired 
anti-reflective properties. The picture quality would be strongly impaired or the color of 
the picture would appear distorted.

The anti-reflective coatings, which were manufactured at Fraunhofer FEP, were installed 
into the demonstrator of SeeReal Technologies. There, holography has already become 
reality. To produce significantly larger displays in the square meter range with the same 
precision is an ambitious goal. To achieve it, Fraunhofer FEP is also well equipped. It has 
the latest state-of-the-art pilot plant technology as well as the know-how for manufac-
turing demanding layer systems for the customer-specific development and production 
of the required coating components.

Find out more about our work:

Daniel Glöß
*Bidirectional Expansion of Collimated Laser Beam as Backlight for Holographic 3D Display*
Speech at the Exhibitor Forum, Session 6: Innovative Display Technologies and Applications 
Thursday, June 4, 2015 | 9.15 a.m. | Executive Ballroom 210

John Fahlteich
*Roll-to-Roll Manufacturing of Functional Substrates and Encapsulation Films for Organic 
Electronics: Technologies and Challenges*
Speech at the Symposium: 10.1 (Invited Paper), 
Tuesday, June 2, 2015 | 2.00 – 2.20 p.m. | Ballroom 220C
The Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP works on innovative solutions in the fields of vacuum coating, surface treatment as well as organic semiconductors. The core competences electron beam technology, sputtering and plasma-activated deposition, high-rate PECVD as well as technologies for the organic electronics and IC/system design provide a basis for these activities. Thus, Fraunhofer FEP offers a wide range of possibilities for research, development and pilot production, especially for the processing, sterilization, structuring and refining of surfaces as well as OLED microdisplays, organic and inorganic sensors, optical filters and flexible OLED lighting. Our aim is to seize the innovation potential of the electron beam, plasma technology and organic electronics for new production processes and devices and to make it available for our customers. COMEDD (Center for Organics, Materials and Electronic Devices Dresden) with all known activities in organic electronics is now acting as a new business unit at Fraunhofer FEP, Dresden, Germany.

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