Multilayer Multimaterial Nanoimprinting combined with Inkjet Printing

M. Mühlberger, A. R. Moharana, H. Außerhuber, S. Kopp, T. Mitteramskogler, D. Fechtig

PROFACTOR GmbH, Steyr, 4407, Austria
e-mail: michael.muehlberger@profactor.at

Nanoimprint Lithography [1] can be done on large areas (e.g. [2]) as well as on curved surfaces (e.g. [3,4]), both of which pose interesting challenges on material deposition. One advantage of UV-based nanoimprinting is the fact that there is a big variety of UV-curing materials available that have different mechanical, chemical or optical properties and can be coated in different ways. The combination of different materials, especially materials with different optical properties could give rise to interesting optical applications. We use plate-to-plate as well as roll-to-plate [5] nanoimprinting to perform multi-layer processes by combining different materials on top of each other. We are exploring combinations of different materials from suppliers like e.g. micro resist technology [6], Inkron [7] and Solvay Solexis [8].
Figure 1 shows the schematic layer sequence for the samples shown here. A first nanoimprint is performed on a glass substrate using a low refractive index material. Subsequently a material with a higher refractive index is deposited and also nanostructured. Finally the layer stack is covered by a flat layer of the low index material. As can be seen in figure 2 the area with the high index material is clearly visible. Figure 3 shows the diffraction pattern resulting from the three different areas. In the region with the high index material, the optical effect results from both nanopatterned layers (low index layer and high index layer). Using a high refractive index material that can also be inkjet printed provides high flexibility in pattern design when using a full area nanoimprint stamp. Figure 4 shows such an example on a 10x10cm² glass substrate, like it can be processed using roll-to-plate nanoimprinting.
We will report on the optical properties of the used materials, the processing conditions and show large area results obtained by roll-to-plate nanoimprinting and inkjet deposited materials.

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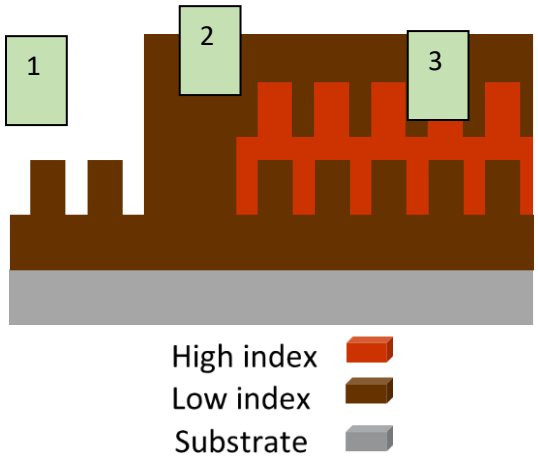

Figure 1. Schematic layer sequence for the multilayer stack. The high index material can also be inkjet deposited

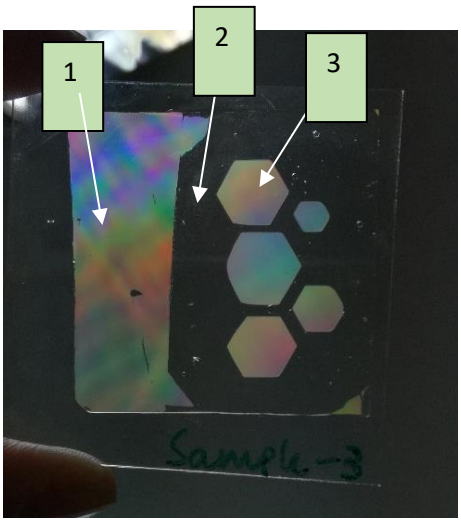

Figure 2. Photograph of a sample obtained by plate-to-plate nanoimprinting indicating the three different areas, shown in figure 1.

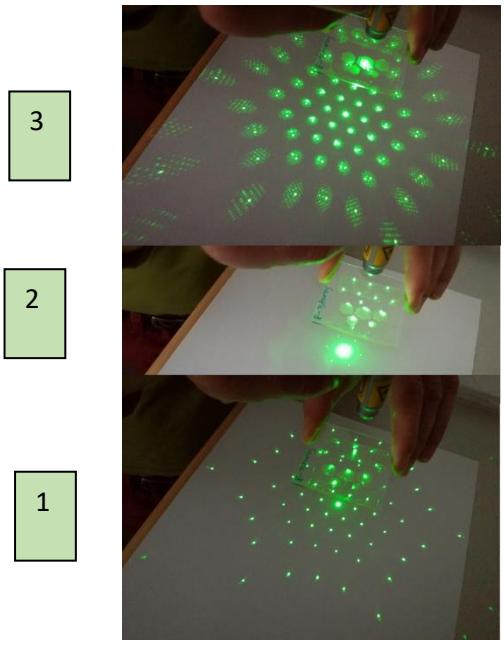

Figure 3. Diffraction patterns obtained from different areas of the sample shown in figure 2. From bottom to top: Standard pattern in area 1, no diffraction from area 2 and double pattern from area 3.

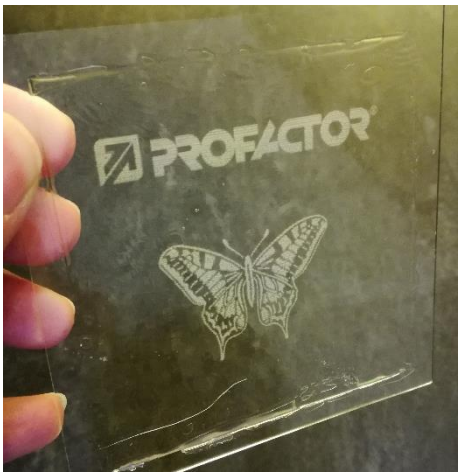

Figure 4. 10x10cm² sample with inkjet deposited and nanoimprinted high refractive index material.