NANOIMPRINT LITHOGRAPHY ON 8'' WAFERS : RESOLUTION AND UNIFORMITY

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The NanoImprint Lithography (NIL) is a promising technique for numerous applications, which needs an extension of the printed surface to be successful for industrial applications. The objective of this paper is to demonstrate that it is possible to print a 8'' wafer in one step by a full printing process to duplicate E-beam structures. Another objective is to study the uniformity of the printed patterns on a so large surface. 8'' full wafer processes have been performed on a EVG®520HE equipment.

The figure 1 presents a 8'' Si mold (on the left) and its duplication into the printed polymer (on the right). The mold, and therefore the printed polymer exhibit pattern sizes from 100 µm to 250 nm. The structures are defined on all the 8'' surface and reproduce even the roughness observed on the mold lines. This can be observed on the 250 nm lines of figure 2. The 8'' printed wafers confirm the mold deformation. A 8'' wafer is not completely flat and exhibits a flatness of several microns and a wedge as high as 10 or 20 µm. If so rough wafers were very hard, the printed patterns would be obtained only at the places where the two wafers are in contact. Indeed all the 8'' surface is well printed, thanks to the mold deformation.

A key point of nanoimprint lithography is the printing uniformity. The residual thickness (hr) has been characterized systematically on SEM cross sections. It has been shown that the residual thickness is uniform across the wafer surface in big patterns in the 100 µm range, but also in smaller lines of 250 nm. This is shown in figure 2 where hr is measured in each field along the wafer diameter. The residual thickness is uniform, except at the periphery. These results demonstrate that the uniformity of the applied pressure and of the printing process on the all 8'' surface.

The interest of this technique is that it can be used to duplicate nanostructures faster, compared to E-beam lithography. It has still to be proved that a 8'' printing process can produce small features. Figure 3 presents SEM pictures of sub-100 nm patterns. 75 nm dense lines are well defined. A hole grating is also shown : the hole width is 110 nm whereas the grid lines exhibit a width of 80 nm. The overview demonstrates that these profiles can be obtained over a large area. These patterns have been observed in different locations on the 8'' wafer. Despite these nice results, many difficulties have still to be solved. It will be shown that mold deformation occurs also in E-Beam printed patterns, which lead sometimes to bad profiles.

All the defects which can appear on printed patterns will be summarized : Saffman-Taylor instabilities, flower-like defects, dewetting of the polymer film, bad filling. All these defects will be presented, based on 8'' observation. They will be related to the polymer film properties.

In conclusion, these results will nevertheless demonstrate that the full wafer printing can be successfully achieved on a 8'' wafer, with a uniformity control allowing a possible transfer of this technique for industrial applications

Figures:

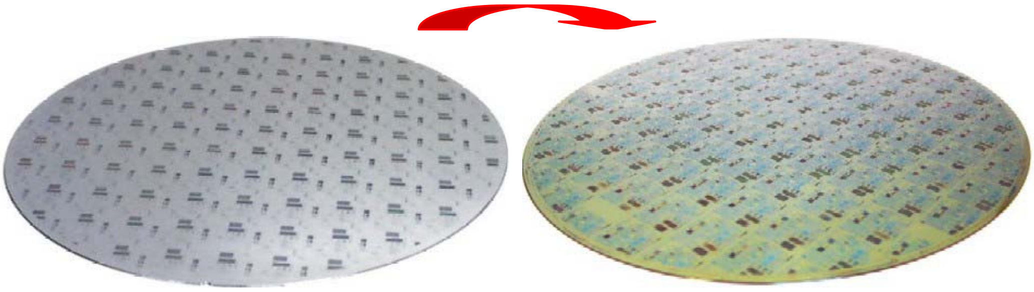
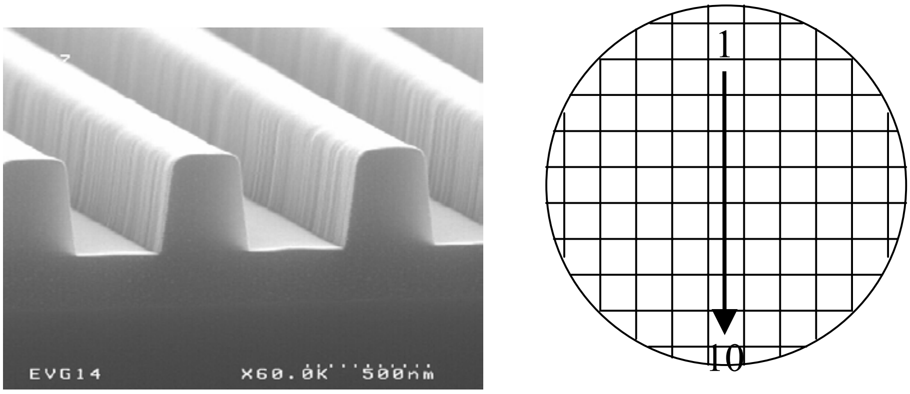


Figure 1 : mold (left) and 8'' printed wafer (polymer : NEB22)



	hr
1	118 nm
2	119 nm
4	113 nm
5	105 nm
6	117 nm
9	117 nm
10	152 nm

Figure 2 : 250 nm printed lines and the uniformity of the residual thickness in these lines along one diameter.

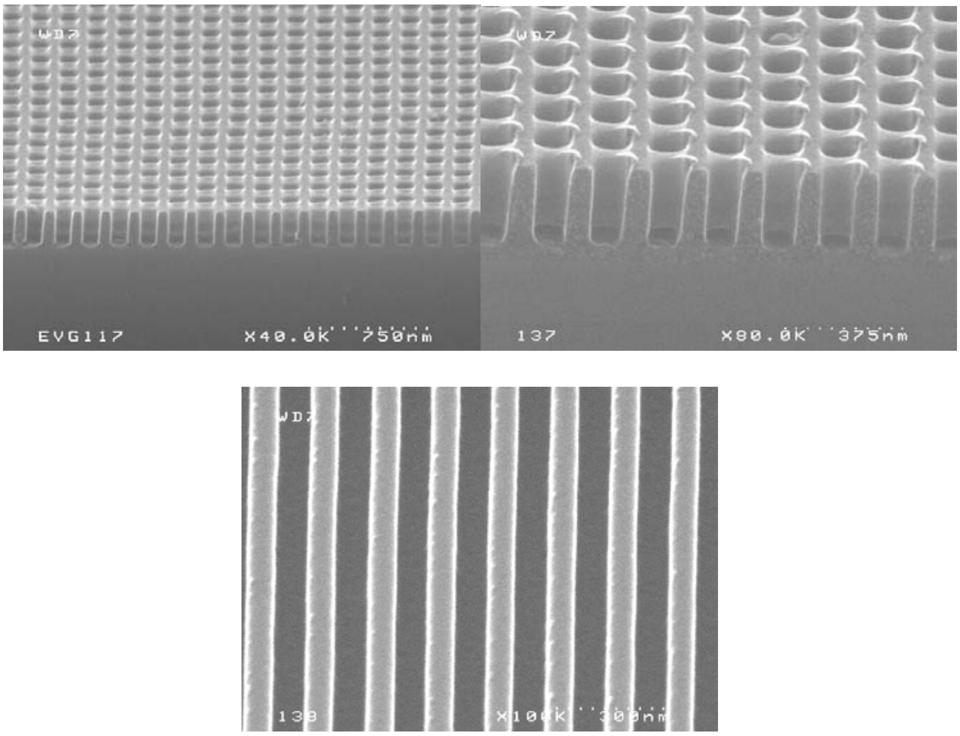


Figure 3 : 110/80 nm hole grating and 75 nm lines printed with a 8'' process