Patterning of DLC leaky waveguide sensors using nanoimprint lithography

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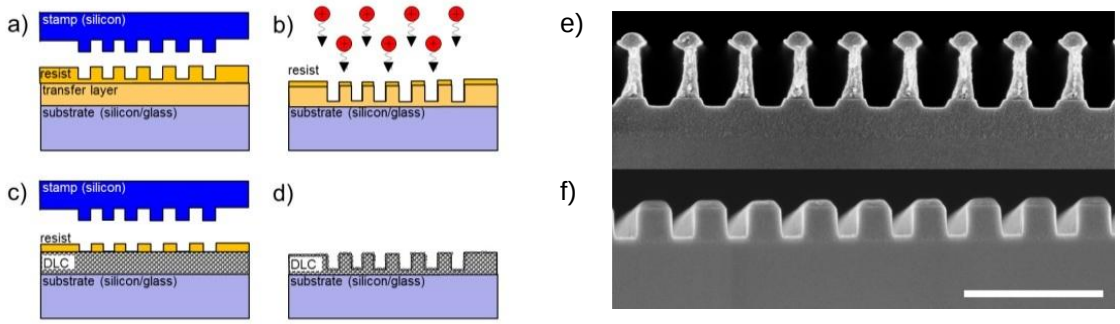
Patterning of materials such as diamond is of interest for a number of application, such as stamps in NIL or hard X-rays optics, due to their unique properties (i.e. high hardness, chemical inertness). Particularly diamond-like carbon (DLC) films have become attractive because of their cost-efficient fabrication and room temperature deposition. During the growth of the DLC film it is possible to dope it with nanometer scale clusters of metals (i.e. silver, copper, etc.). This is an additional advantage since it further broadens their application spectrum [1]. In this work we present a method capable of pattern DLC films in a straightforward way by using thermal nanoimprint lithography (T-NIL) and a simplified process for pattern transfer using hard masks [2].

We used the SiPol resist (micro resist technology GmbH), a thermoplastic resist with a 10% content of covalently bonded silicon that makes it highly resistant to oxygen plasma [3]. Initially Sipol was developed to be used in bilayer system with an organic transfer layer like (UL1) (Fig. a, b, e). Here, SiPol is used directly on DLC (c+d). An “incomplete filling” strategy was employed by using stamps with 250 nm deep patterns. T-NIL was optimized at low temperature (90°C) to avoid other issues such as lack of adhesion, capillary effects or dewetting. This allowed “zero” residual layer imprint and etching the DLC films (f).



We develop periodic structures based on DLC which enables to manufacture leaky waveguide sensors. As a result, it is possible to obtain a sensor based on a grating structure that is highly sensitive to the change of the refractive index of surrounding media.

References

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