TiO_2 nanoimprint for photonic sensor application

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Nowadays, there is a huge demand for single-use point-of-care diagnostics systems for the detection of early diseases (such as cancer or infectious diseases). Photonic crystal biosensors have been developed as a very promising technology [1-2]. However, so far, photonic devices suffer from several drawbacks that severely limit their applications as single-use point-of-care tools, in particular the high environment impact and high cost of their manufacturing that is mostly based on semiconductor technologies [3].

In this context, our project is mainly to explore alternative photonic devices that are compatible with cost-effective and low environmental impact materials and fabrication processes, while offering good optical properties for sensing: high refractive index, high transparency, high reproducibility. Among other technologies suitable for low-cost and "greener" production, nanoimprint lithography (NIL) is considered a cost-effective manufacturing process that is suitable for photonic device fabrication [4]. Regarding materials, titanium dioxide (TiO_2) is a candidate of choice for NIL nanopatterning, as it can be imprinted in the form of sol gel [5] and it presents the desired high transparency and high refractive index, which should ensure high-performance devices. Our strategy is therefore to set up a process based on the NIL technique for the fabrication of TiO_2 photonic crystal biosensors. Two different routes are investigated, a soft NIL process and thermal nanoimprint on the NPS 300 equipment at INL. In this short presentation, I will give an overview of the challenges and of my latest results, which are illustrated in figure 1 in the case of soft NIL.

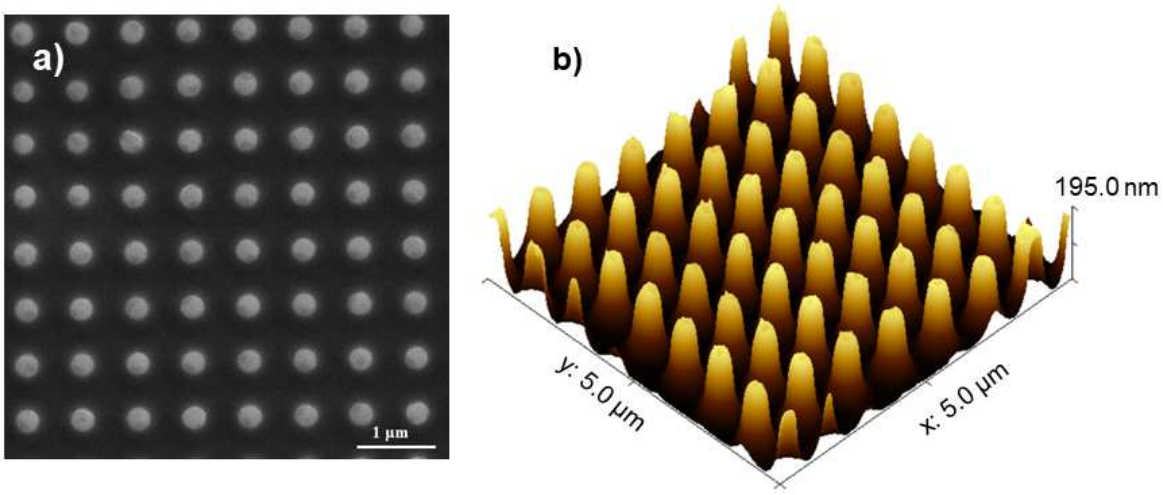

Figure 1 - *Example of imprinted TiO_2 photonic crystal (2D pattern with radius 150 nm and period 700 nm):* ***a)*** *SEM and* ***b)*** *AFM image.*

References

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