1- Publishable summary

The present deliverable summarise the work that has been done by P3SENS Consortium during the second year (January 2011-December 2011). The efforts of the partners mainly focused on material developments (WP4), design of the photonic structures (WP3), e-beam fabrication of silicon stamps for NIL (WP3), patterning on polymers by NIL (WP5), patterning on polyimide deposited over a rigid wafer (the so called "hybrid" solution) by NIL (WP3), adhesion of polymer materials (WP4/WP8), and surface chemistry and ELISA tests (WP7).

Because of the technological challenges encountered by using the polyimide (a rather rigid material requiring a temperature exceeding 300°C for being imprinted) as a HRI material, the Consortium has been forced to first develop the tools for enabling the processing of the polymers used in the fabrication of the photonic chip. In particular a rather sophisticate design of the stamp for NIL (4 layer fabrication) was needed for enabling the proper "flow" of the polyimide during the NIL (see the details on the section concerning the activity for WP5).

Also the compatibility of LRI with HRI polymers was far from being perfect (as typically the LRI materials are fluorinated polymers that have intrinsic hydrophobic properties and therefore do not permit the adhesion of a polyimide top layer in normal conditions). A plasma treatment has been developed and tested for improving the "wetting" of the LRI polymers for better adhesion with the polyimide.

As a general consideration, working with such materials - for both the full polymer and hybrid stack - has been very challenging and a more in deep analysis of the material properties has been required before the Consortium can proceed to the fabrication of the photonic chip.

At the present day, a better understanding of the behaviour of such polymers has been achieved (including the compatibility with water and alkaline solutions). However the best results obtained are often difficult to reproduce and typically differ at each time (i.e., they change from sample to sample), which makes the approach to the fabrication of the photonic chip on larger scale very challenging indeed (repeating the same protocol twice does not give necessarily the same result twice).