Disposable plasmonic-fluidic sensors

Diagnostic devices consist of numerous photonic and non-photonic components that need to be combined for the required functionality. Modular blocks with preliminary division enables a structured approach to highly fragmented heterogeneous technologies used in component manufacture and device integration. For each case, the fabrication chain is designed by choosing the relevant blocks. Model-Cases are chosen to create libraries for four segments: photonics component manufacture, non-photonic peripheral manufacture, device integration and post-processing. MedPhab enables small and medium scale manufacturing of nanostructured substrates together with surface metallization processes and has established processes for their integration with microfluidic structures. This will help to address the need for signal enhancing substrates required for highly sensitive molecular diagnostics.

Medphab Partners

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MedPhab

Photonic Medical Devices

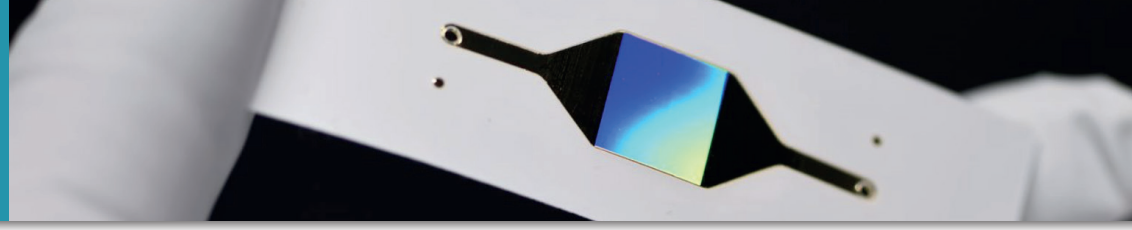
Disposable plasmonic-fluidic sensors

Pilot production of integrated microfluidic structures for highly sensitive molecular diagnostics

Model Case for Molecular Diagnostics

www.medphab.eu

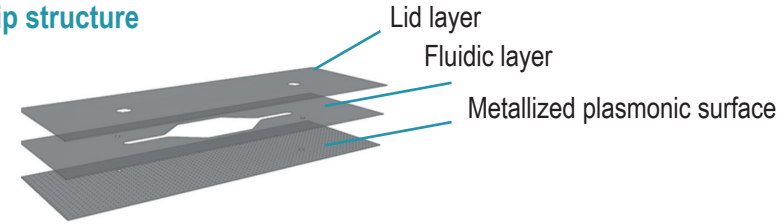
Realisation of a fully automated, high-volume manufacturing process for plasmonic-fluidic sensors by linking capabilities at VTT and Joanneum Research



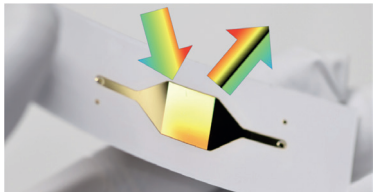
Design of photonic structure, VTT

- Plasmonic surface grating was designed using rigorous coupled wave method.
- Optimal structure was chosen regarding the performance and manufacturability.
- Small scale stamp master* according to design was realized.

Sensor chip structure



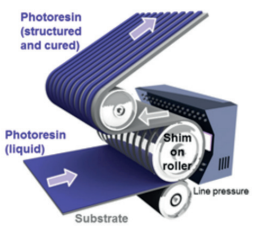
Operational principle

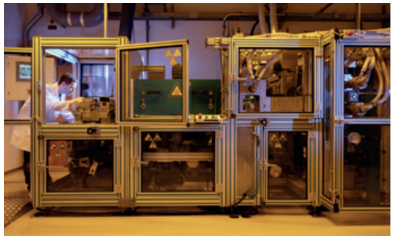


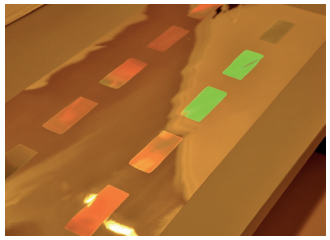
When light hits the plasmonic surface, intensity of the wavelength exciting the surface plasmon is reduced in the reflected light.

Sensor surface by roll-to-roll UV nanoimprinting lithography, Joanneum Research

- Large scale manufacturing of nanophotonic plasmonic sensor part.
- Large area imprinting tool for R2R UV-NIL by upstepping process.
- R2R replication of plasmonic sensor surface.
- R2R / Sheet-level metallization of sensor surfaces.



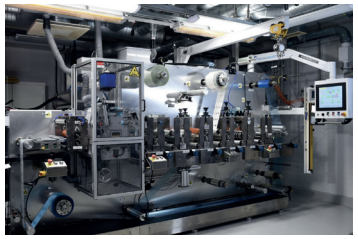


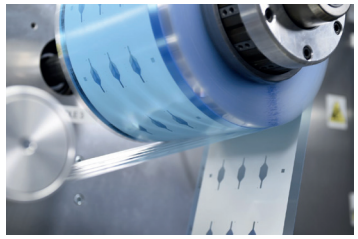


*University of Eastern Finland is acknowledged for preparing master tool by e-beam lithography.

Roll-to-roll manufactured tape microfluidics, VTT

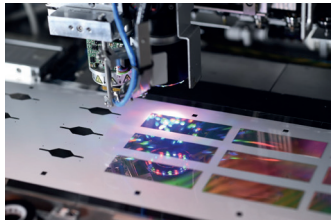
- Laminated structure formed by fluidic layer (double sided tape) and lid layer with vias.
- Structures patterned by laser cutting.





Hybrid integration and singulation, VTT

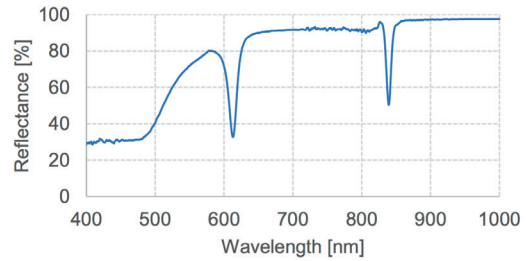
- Plasmonic sensor surfaces hybrid assembled to the microfluidic roll by pick-and-place process.
- Complete sensors singulated from the roll by cutting tool.



Characterization, VTT

- Reflection spectra was characterized from 20 sensors using a spectrophotometer.
- Simulated and measured diffraction efficiencies were in good agreement.
- Coefficient of variation (CV) was 2%.

Reflectance spectrum



Full report and videos on manufacturing, see **www.medphab.eu/offering**