

# Photonic Bandgap Biosensing Structures Biofunctionalized with Molecular Beacon Probes

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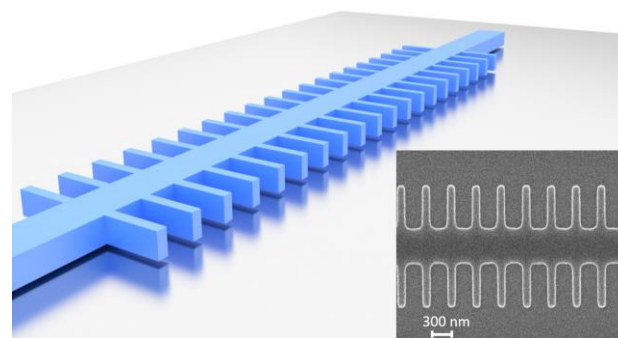
Given the relevance of the detection of RNA/DNA for bioanalysis and biomedical research [1,2], we propose a ground-breaking label-free strategy for detecting oligonucleotide strands based on silicon photonic bandgap (PBG) structures biofunctionalized with molecular beacon (MB) probes [3]. Complementary target oligonucleotides were specifically recognized through hybridization with the MB probes on the surface of the PBG sensing structures, exhibiting remarkable PBG edge shifts even in the range of  $\sim 1100$  pm vs. around 20-90 pm for typical shifts obtained using ring resonator based sensors [4]. These shifts indicate a very high sensitivity of the PBG sensing structure towards small local refractive index variations being produced in its surface. Such high sensitivity was then used to exploit the hairpin conformational changes of MBs upon hybridization for changing the interaction of a particle-labelled MB over a PBG sensing structure, since the conformational change promotes the displacement of the particle away from the surface of the sensor. To this end, a biotin moiety was added to the MB in order to selectively bind a streptavidin

molecule to it. Our experimental study demonstrates, for the first time to our knowledge, the influence of the conformational change suffered by MB probes upon the biorecognition of target oligonucleotides over evanescent wave photonic sensors.

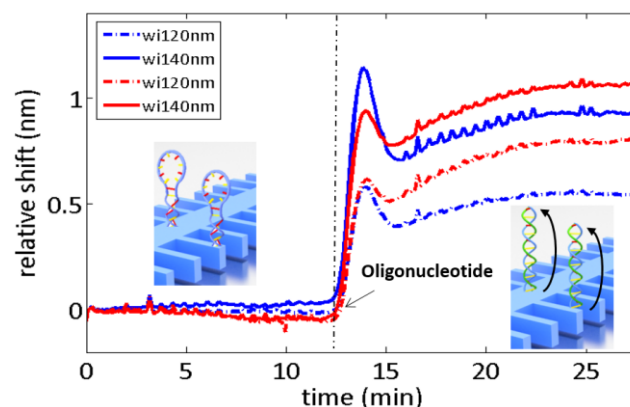
## References

- [1] I. Casanova Salas, et al., *Clin Transl Oncol*, 14 (2012) 803-811.
- [2] E. Y. Liu, et al., *Dis model Mech*, 10 (2017) 509-518.
- [3] S. Tyagi and F. R. Kramer, *Nat Biotechnol*, 14 (1996) 303-308.
- [4] A. J. Qavi and R. C. Bailey, *Anal Chem*, 84 (2012) 793-821.

## Figures



**Figure 1:** Schematic representation of the 1D PBG sensing structure (inset: SEM image of a fabricated PBG sensing structure).



**Figure 2:** Spectral shifts of the PBG edge when the oligonucleotide detection takes place.