ASEC 2021

2nd International Electronic Conference on Applied Sciences, Online, 15-31 October 2021

Gold nanogratings on polymers for plasmonic biochemical sensors

F. Arcadio*, L. Zeni, C. Perri, and N. Cennamo

Department of Engineering,

University of Campania L. Vanvitelli,

Via Roma, 29

81031 Aversa, Italy

G. D'Agostino, G. Chiaretti, and G. Porto

Moresense srl

Viale Ortles, 22/4

20139 Milan, Italy

*Email: francesco.arcadio@unicampania.it

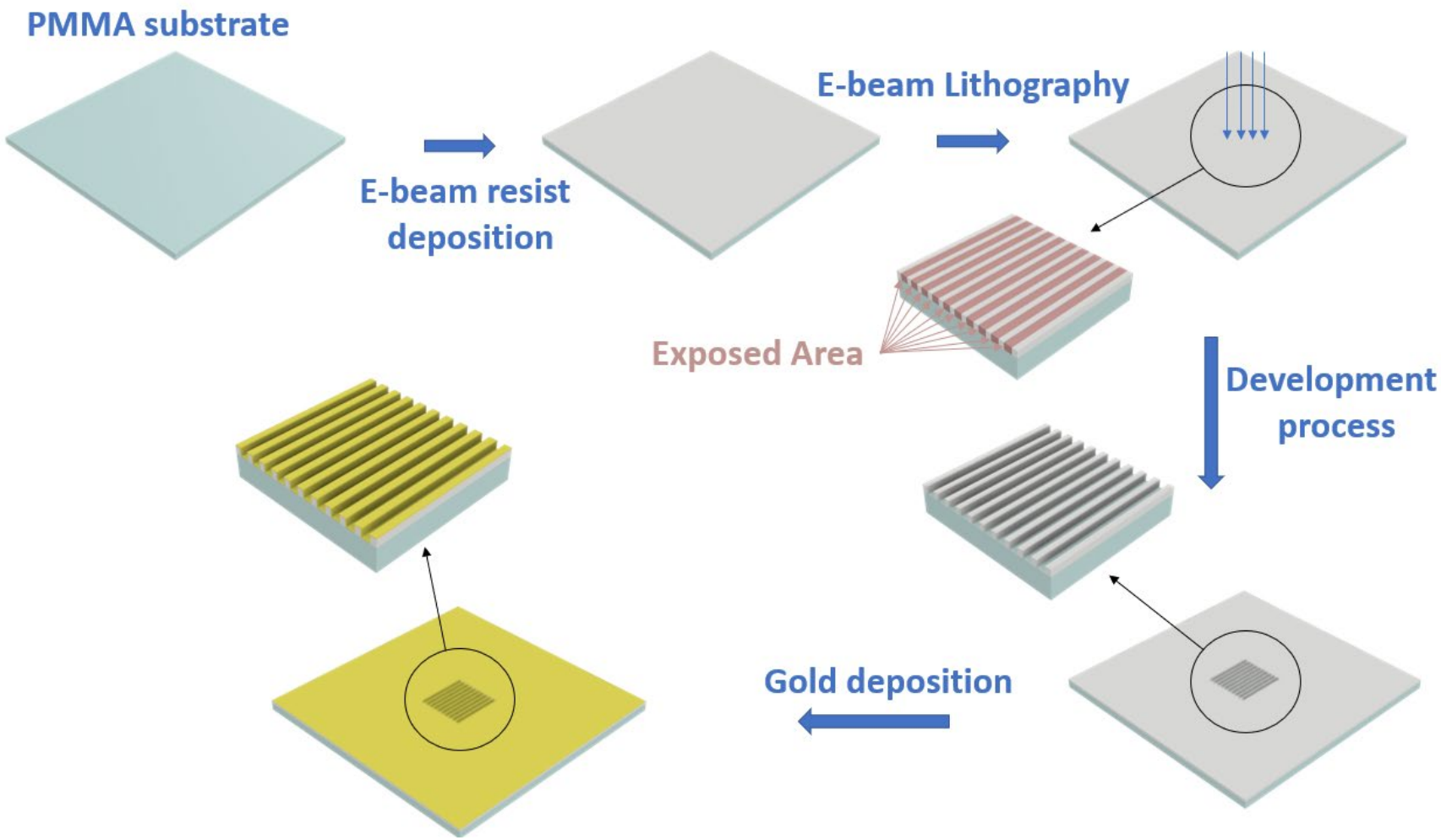
Gold nanogratings on polymers for plasmonic biochemical sensors

Outline

- Sensor fabrication process
- Experimental configurations
- Experimental results: BSA detection
- Conclusions

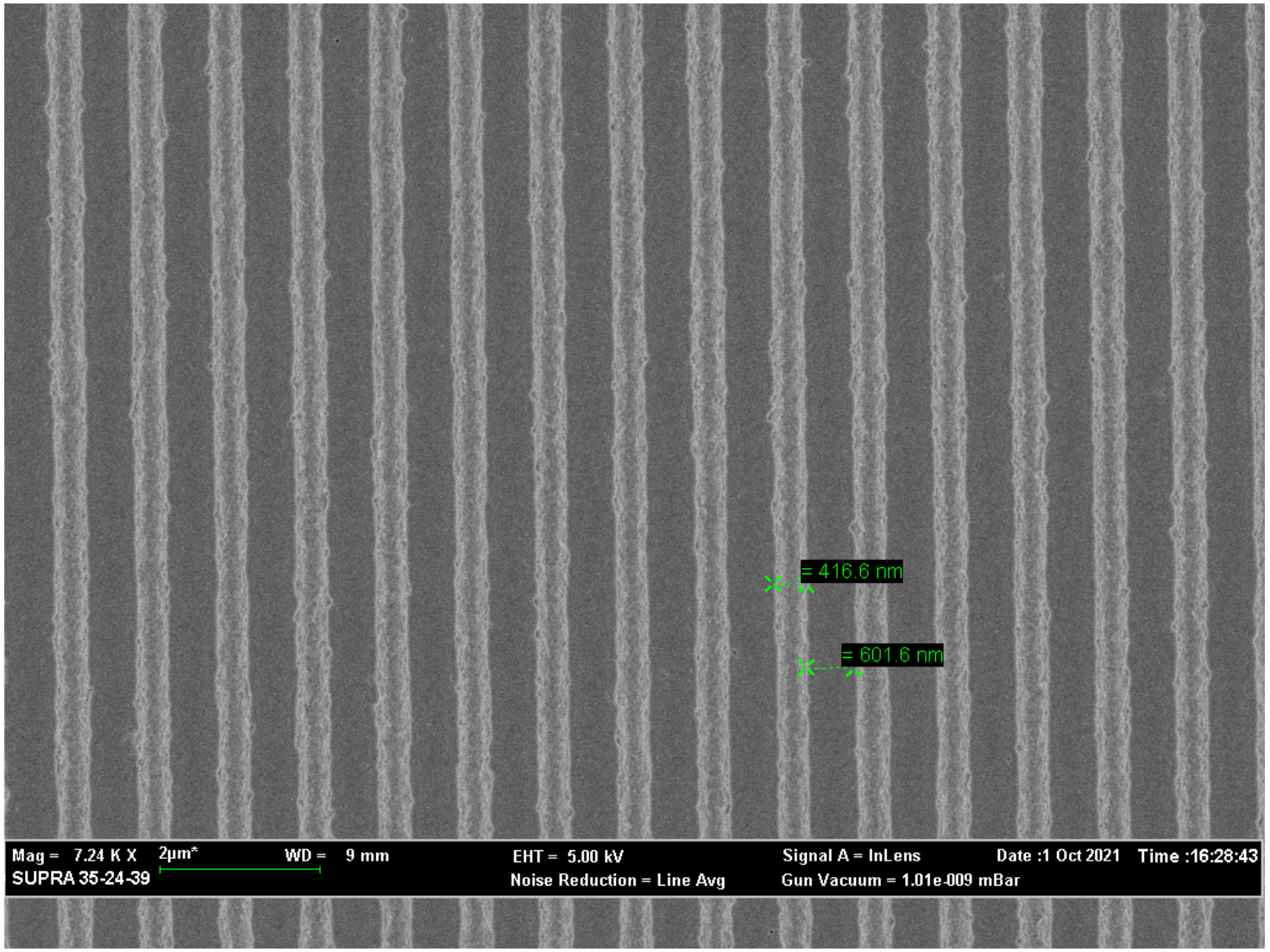
Plasmonic sensor system

Fabrication process



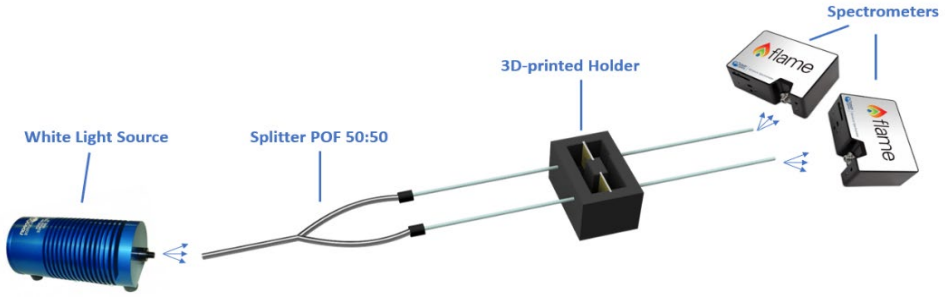
Plasmonic sensor system

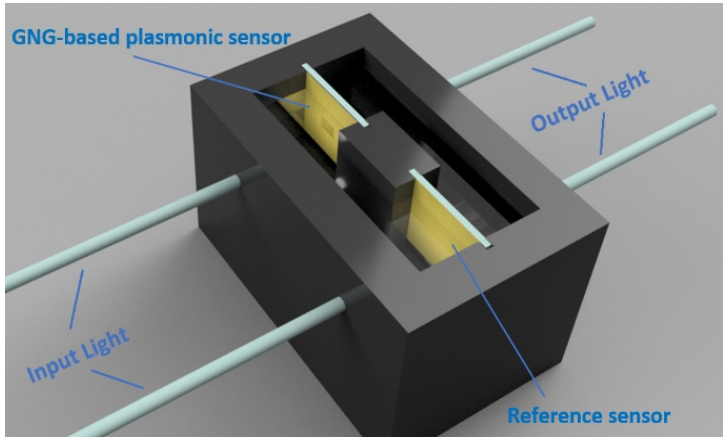
Fabrication process



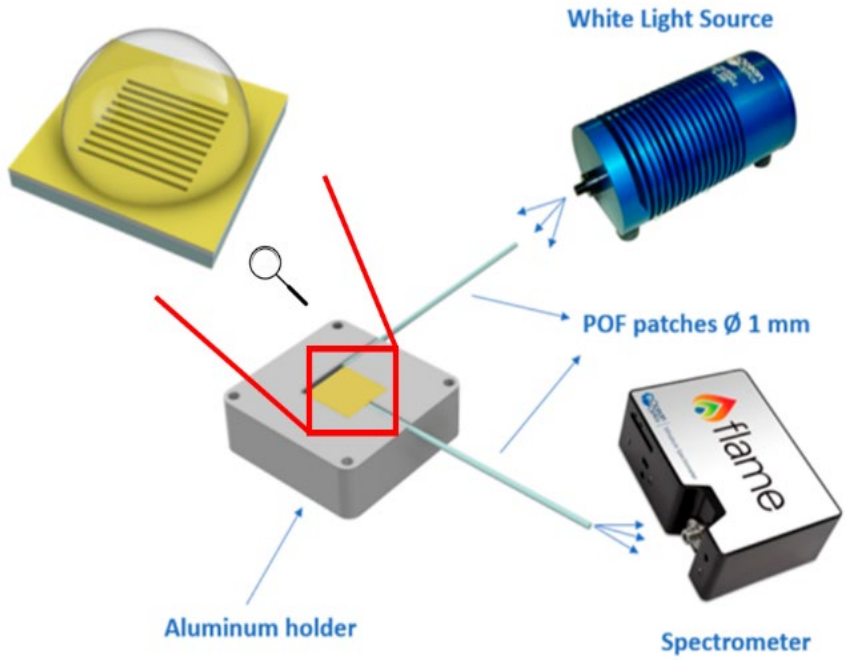
Plasmonic sensor system

Experimental configurations





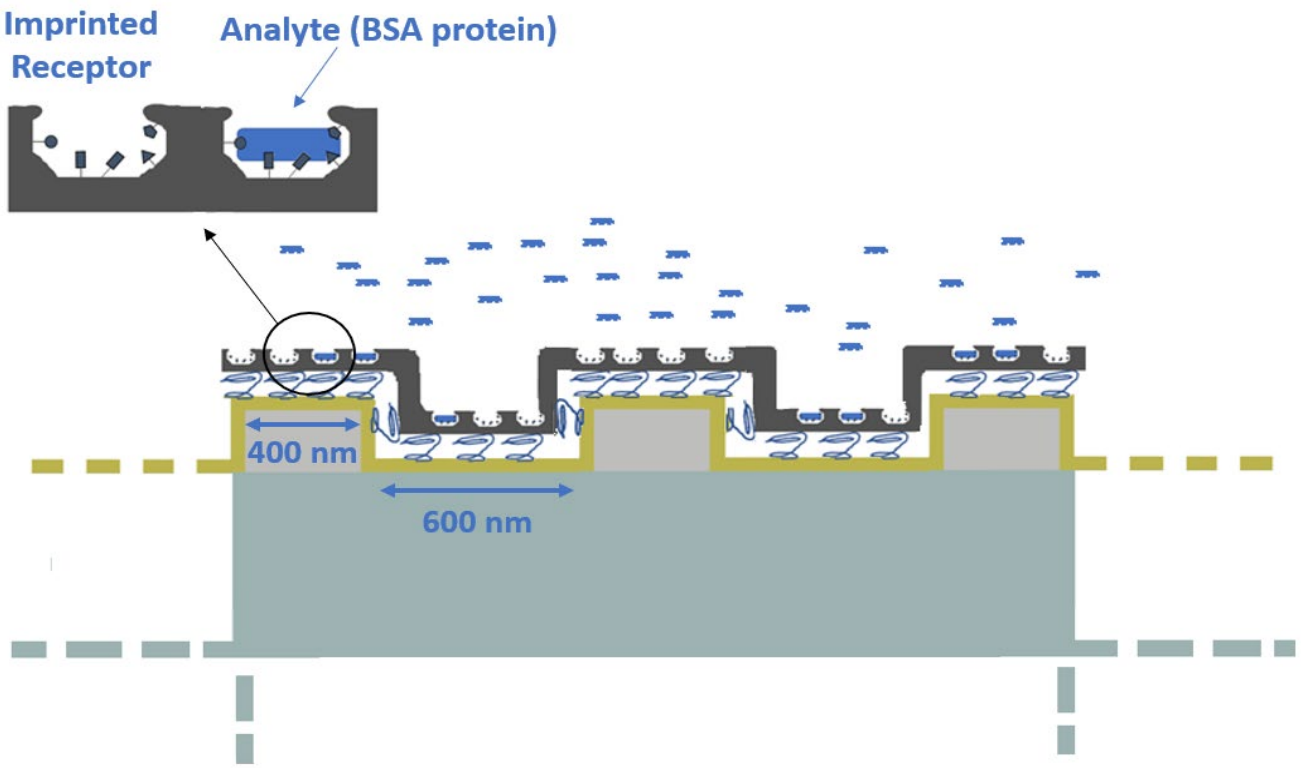
Experimental configuration 1: PMMA chip as a transparent substrate



Experimental configuration 2: PMMA chip as a slab waveguide

Experimental results

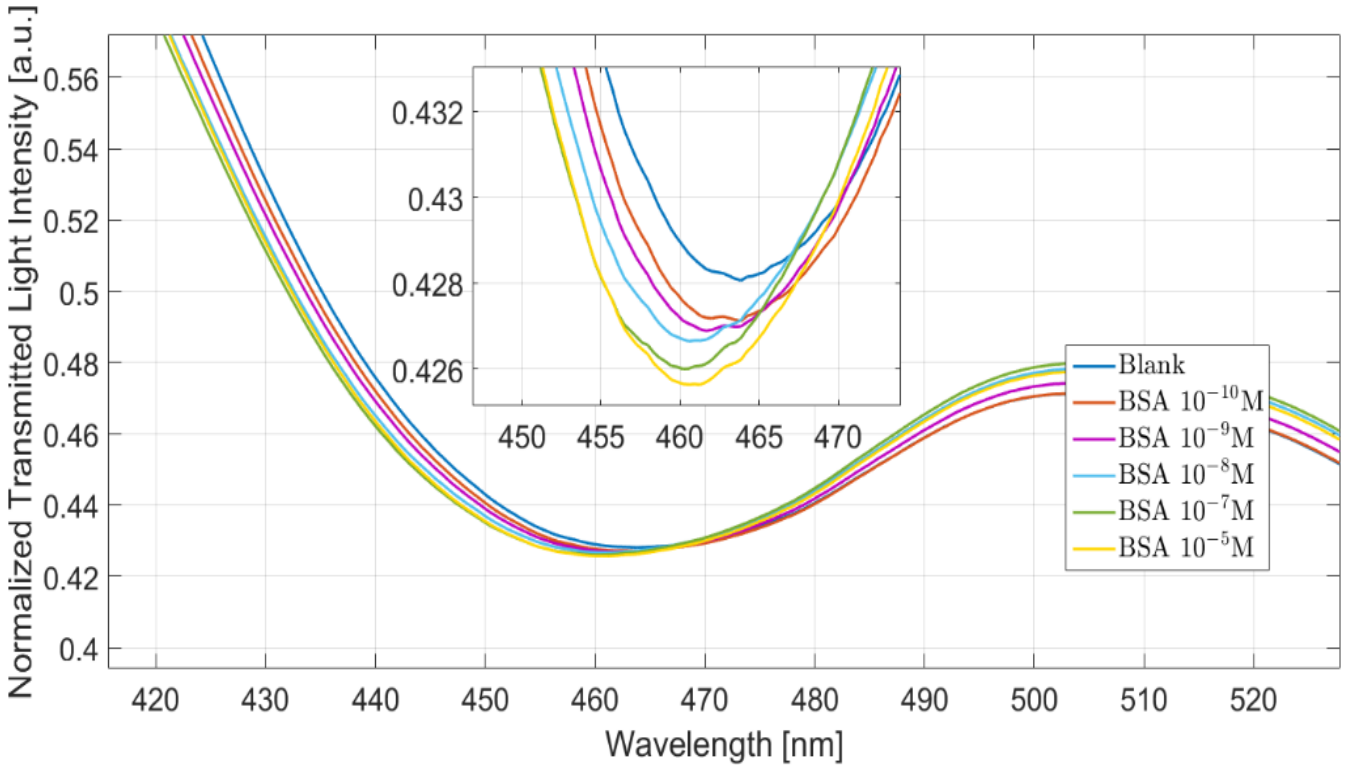
A binding test: BSA detection



The biochemical sensing capabilities of the developed plasmonic sensor have been tested by depositing a specific synthetic receptor (MIP) for the Bovine Serum Albumin (BSA).

Experimental results

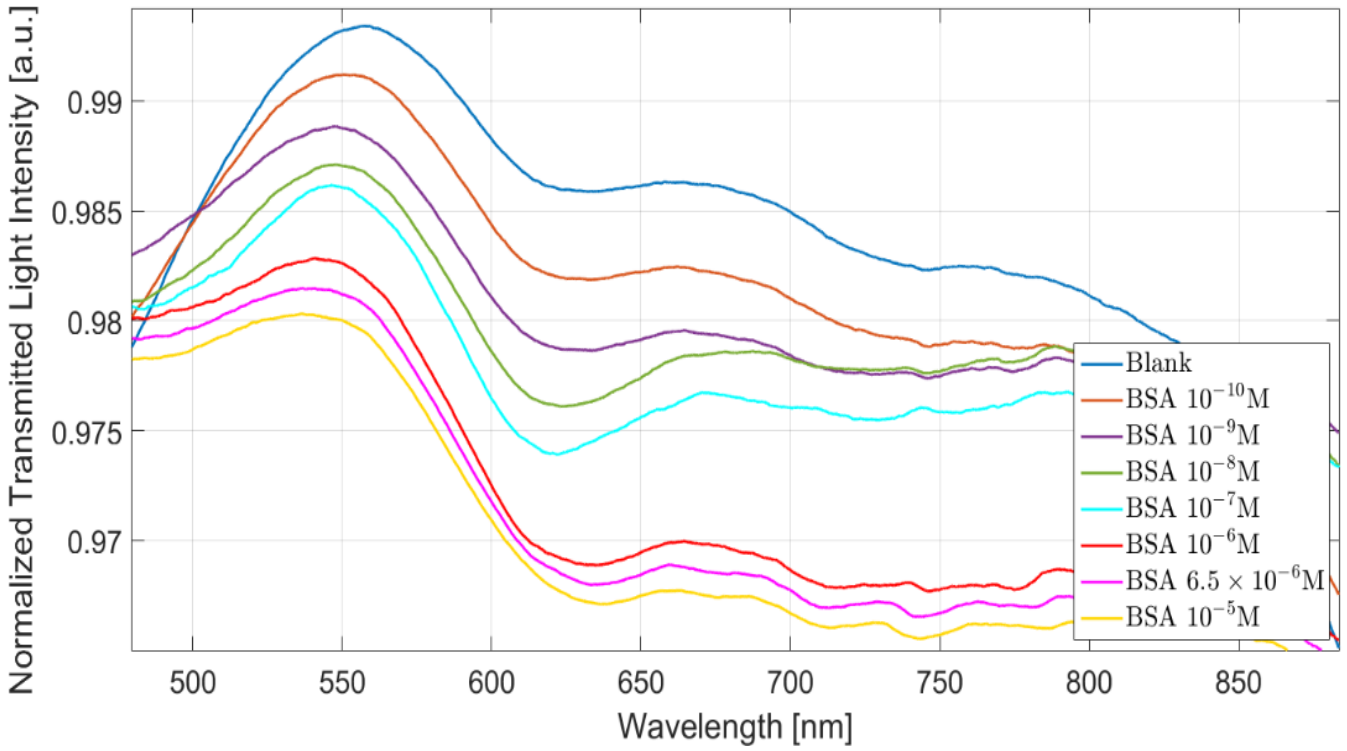
Experimental configuration 1



Francesco Arcadio et al. "Biochemical sensing exploiting plasmonic sensors based on gold nanogratings and polymer optical fibers" ***Photonics Research****, vol. 9(7) (****2021****), pp. 1397-1408. https://doi.org/10.1364/PRJ.424006*

Experimental results

Experimental configuration 2



This experimental configuration denotes the presence of two distinct plasmonic resonances each of one sensitive to a different range of BSA concentrations

Francesco Arcadio et al. "Nanoplasmonic-Based Biosensing Approach for Wide-Range and Highly Sensitive Detection of Chemicals" ***Nanomaterials****, vol. 11(8) (****2021****), p. 1961. https://doi.org/10.3390/nano11081961*

Experimental results

A binding test: BSA detection

Configuration	LOD	BSA detection range	Reference
Gold nanograting on PMMA chip (experimental configuration 1)	37 pM	37 pM – 100 nM	*F. Arcadio et al. "Biochemical sensing exploiting plasmonic sensors based on gold nanogratings and polymer optical fibers"* ***Photonics Research****, vol. 9(7) (****2021****), pp. 1397-1408.*
Gold nanograting on PMMA chip (experimental configuration 2)	23 pM	23 pM – 10 nM	*F. Arcadio et al. "Nanoplasmonic-Based Biosensing Approach for Wide-Range and Highly Sensitive Detection of Chemicals"* ***Nanomaterials****, vol. 11(8) (****2021****), p. 1961.*
	0.54 µM	0.54 µM – 10 µM	
SPR-D-shaped POFs	0.37 µM	0.37 µM – 6.5 µM	*N. Cennamo et al. " Proof of Concept for a Quick and Highly Sensitive On-Site Detection of SARS-CoV-2 by Plasmonic Optical Fibers and Molecularly Imprinted Polymers."* ***Sensors****, vol. 21 (****2021****), p. 1681.*

Conclusions

- A plasmonic sensor based on gold nanograting for biochemical sensing applications has been presented.
- The plasmonic sensor has been tested through two different experimental configurations.
- The experimental binding test results relative to BSA detection have demonstrated an ultra-low limit of detection in the order of pM.
- The proposed GNG-based sensor is cost effective since it is suitable for large-scale production processes.

ASEC 2021

2nd International Electronic Conference on Applied Sciences, Online, 15-31 October 2021

Thank you!

Francesco Arcadio

Department of Engineering,

University of Campania L. Vanvitelli,

Via Roma, 29

81031 Aversa, Italy

email: francesco.arcadio@unicampania.it