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SURFACE PLASMON RESONANCE SENSOR BASED ON INKJET 3D PRINTING

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Outline

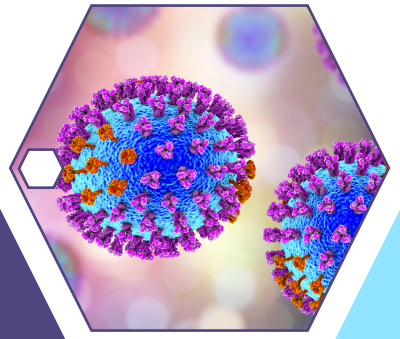
- Introduction
- Surface Plasmon Resonance Phenomenon
- SPR Sensor Design and Fabrication
- Experimental Setup and Results
- Cost Analysis
- Conclusions

Introduction

Plasmonic Biochemical Sensors Applications

Water quality monitoring by measuring concentrations of…

Viruses



Pesticides

Toxic Metals

Copper

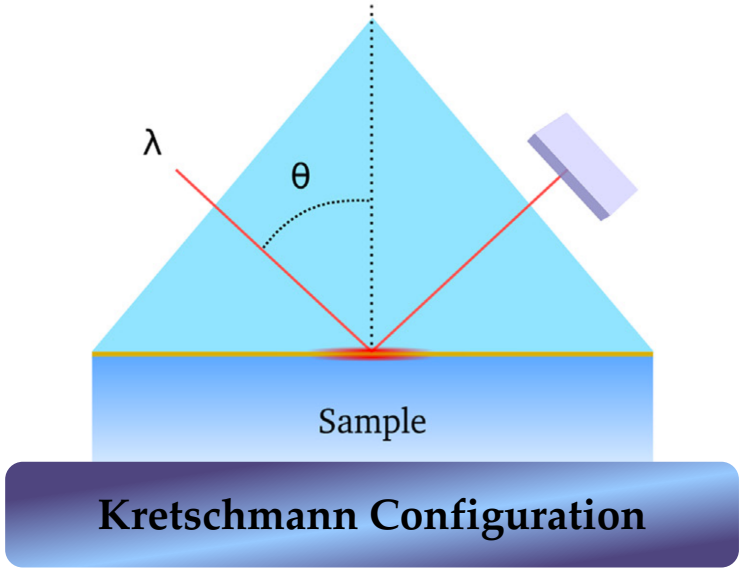
Mercury

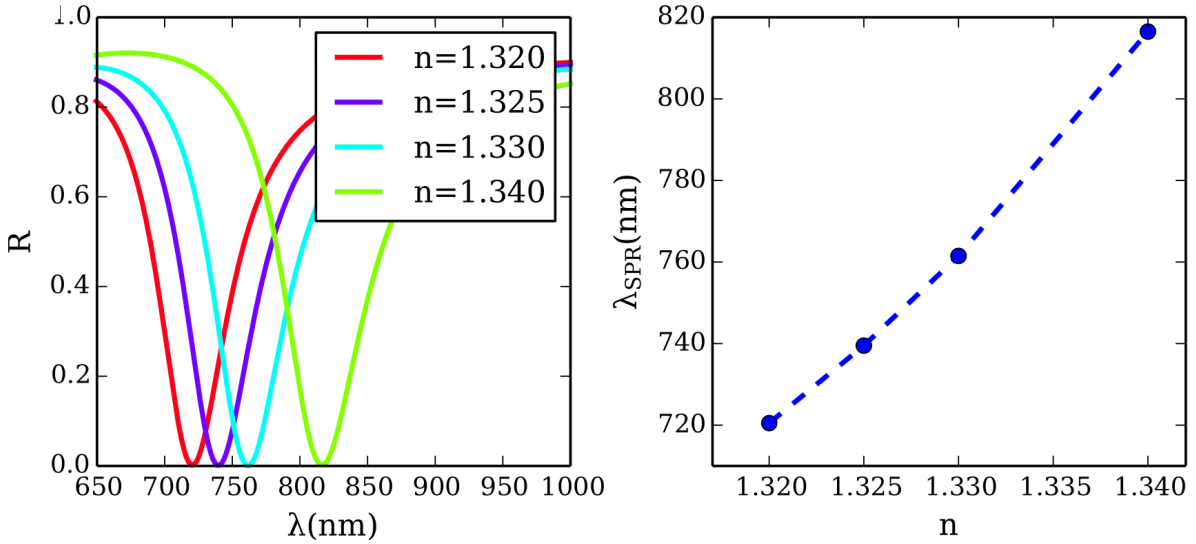
Arsenic

Cadmium

Pollutants

Surface Plasmon Resonance (SPR) Phenomenon





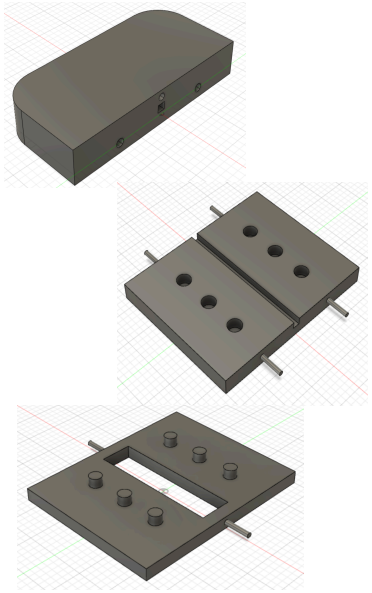
A thin film of noble metal is deposited on a prism. The sample is in contact with the thin film. A beam of light of angle of incidence θ and wavelength λ illuminates the metal/prism interface. At the angle (θ_{SPR}) corresponding to the resonance wavelength (λ_{SPR}), the light is absorbed.

The reflectance presents a ***dip***.
As the refractive index (n) increases, the dip is translated to the high wavelengths (λ_{SPR}).

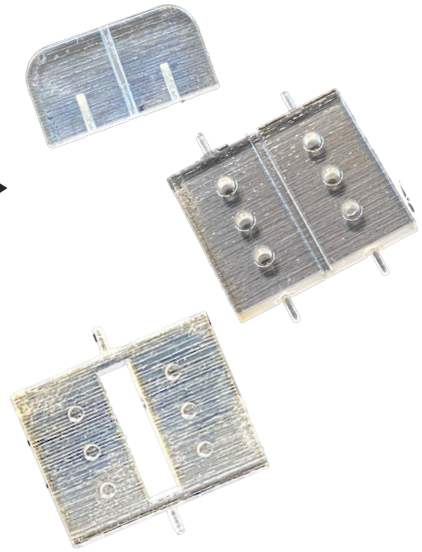
Source: DOI - *10.1016/B978-0-12-809886-8.00003-X*

SPR Sensor Design and Fabrication

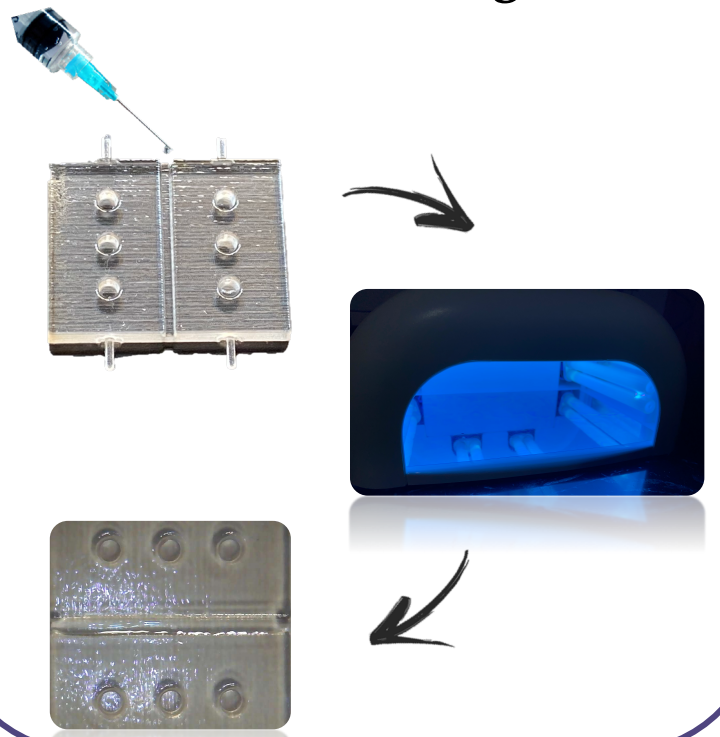
1 – CAD Design



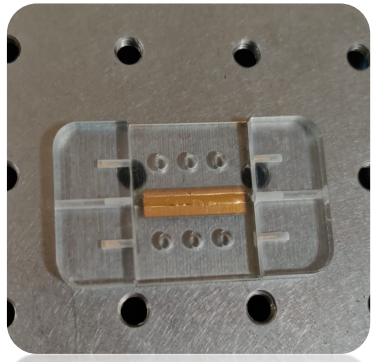
2 – 3D Printing Disassembled Parts



3 – Waveguide Core Manufacturing



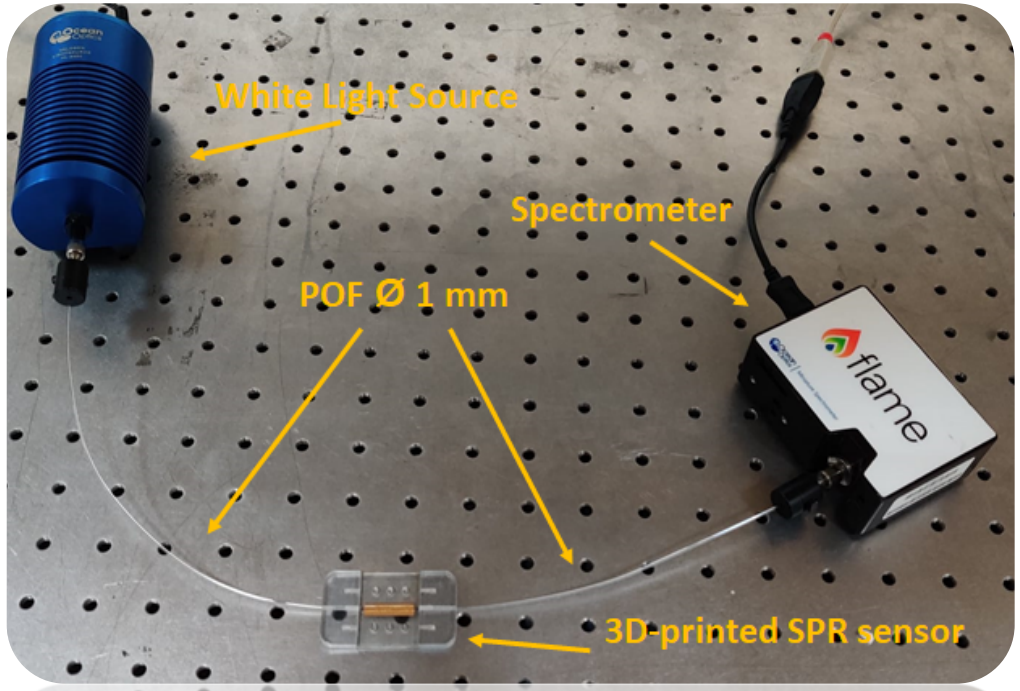
4 – Thin Gold Film Sputtering



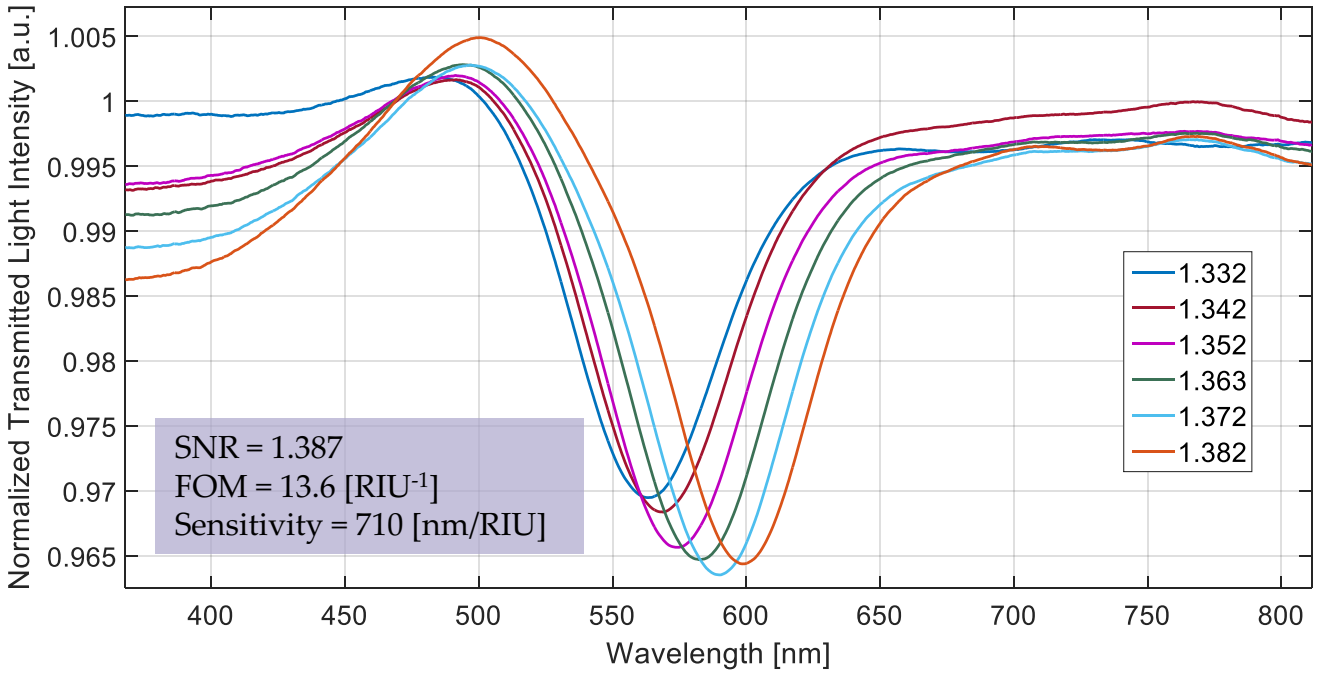
Source: DOI https://doi.org/10.3390/polym13152518

Experimental Setup and Experimental Results

Experimental Setup



Experimental Results

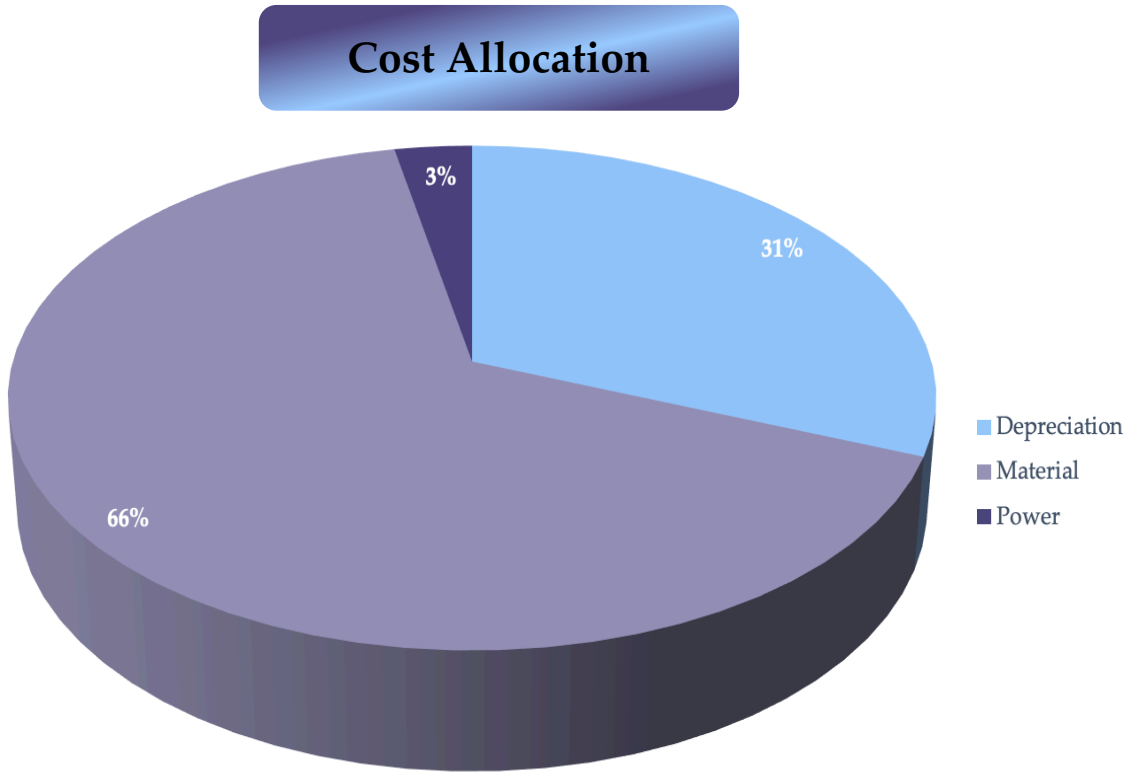


Source: DOI - https://doi.org/10.3390/polym13152518

Cost Analysis

INPUT PARAMETERS		Unit	Value
Material	VeroClear RGD810	€/kg	393,11
	FullCure705	€/kg	126,74
	Norland Optical Adhesive NOA88	€/ml	2,5
Part	Model	kg	0,017
	Support	kg	0,006
	Printing Time	h	0,47
	Optical Adhesive	ml	1,00
Machine	Depreciation Cost	€/h	10,00
Process	Power Cost	€/kWh	0,10
	Labor	€/h	30,00

Total Cost for 1 part production	%	€
Depreciation	31%	4,67 €
Material	66%	9,94 €
Power	3%	0,47 €
Total Cost		15,08 €



Source: DOI - https://doi.org/10.3390/polym13152518

Conclusions

- An SPR sensor was manufactured using a novel approach based on a inkjet 3D Printing.
- The novel approach used makes the sensor easily available for mass production.
- The novel approach used makes it possible to realize cheap SPR sensors (cost = 15€), but it could be even cheaper by using cheaper resins combined with LCD 3D printing technique.
- The SPR sensor developed shown performances good enough to develop a novel kind of plasmonic biochemical sensors for several applications (i.e. concentrations measure of pollutants, viruses, toxic metals, pesticides into aqueous solutions).

Contacts

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Meet The Team!

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Thank you for your kind attention!