Title
Surface Plasmon Band Gap Sensor A new sensor for robust on-field biosensing (SEN 1)

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A new sensor for robust on-field biosensing.

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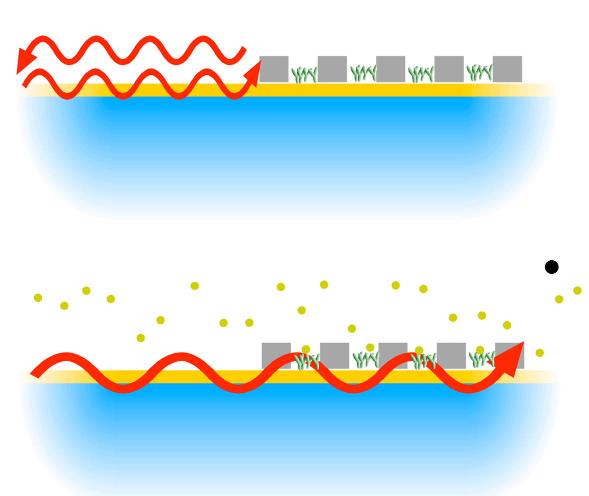
A new sensing concept

Nanostructures for Surface Plasmon Sensing

- Surface Plasmon are surface EM waves whose wavelength is strongly dependent on molecular binding on the surface.
- Measuring their wavelength can be used as a proxy for measuring molecular binding onto the surface.
- We use nanostructures for wavelength measurement using a Fabry-Perot type effect to increase the robustness and portability of the system.



Main Features

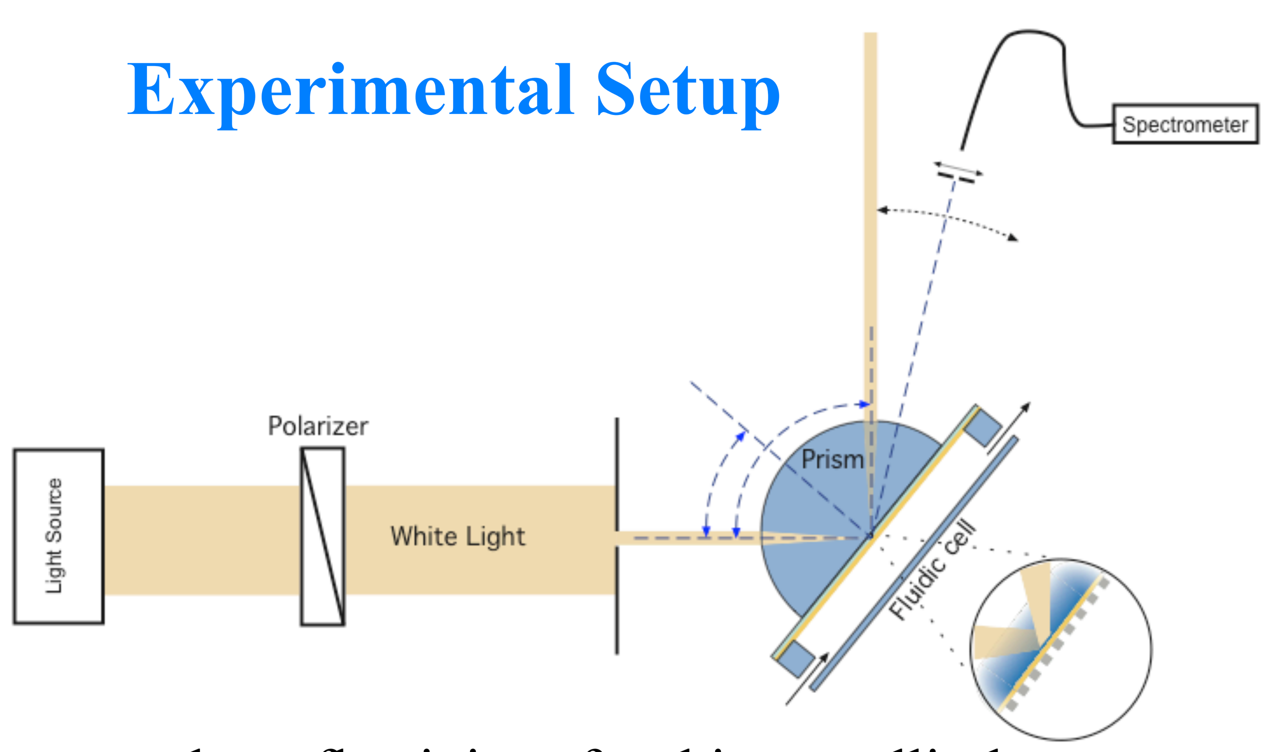
- **Portability**
  - We identified that the control of the beam divergence is a limiting factor in the on-field implementation of surface plasmon (SP) sensors.
  - Our technique cancels the need for a very precise control of the beam divergence and enables the possibility for on-chip SP sensing.
- **Versatility**
  - The most attractive feature of SP sensors is their versatility. Since they are based on the detection of changes in refractive indexes on the surface, they are able to detect a very wide range of chemicals and biomolecules. This is particularly attractive for a wide-reaching organization such as CENS.

Problem Description: Experimental demonstration of SP sensing

We previously numerically demonstrated that Surface Plasmon Band Gap sensing is an attractive technique for biomolecular sensing. Notably, we showed that our sensor outperforms traditional SP sensors when the divergence of the excitation beam is higher than one degree. The divergence of a standard diode, which is used in the miniaturized implementation is 4 or 5 degrees. Here we show how we experimentally demonstrated the validity of our sensing technique by measuring a change of glycerol concentration and comparing it with traditional SP sensing. We notably verified that for beam divergences above one degree, our sensor outperform traditional SP sensing.

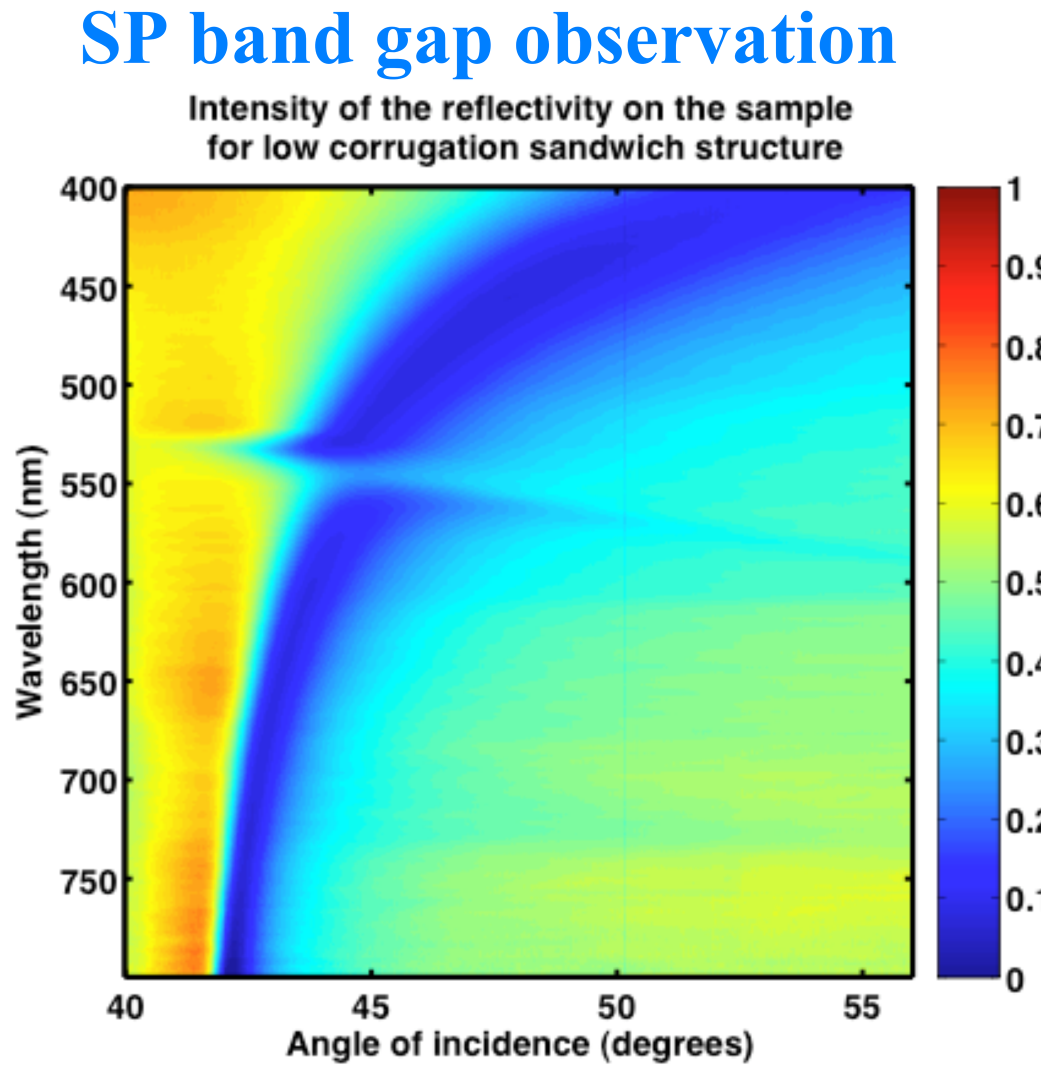
Proposed Solution: Characterization of the sensor performance

Experimental Setup



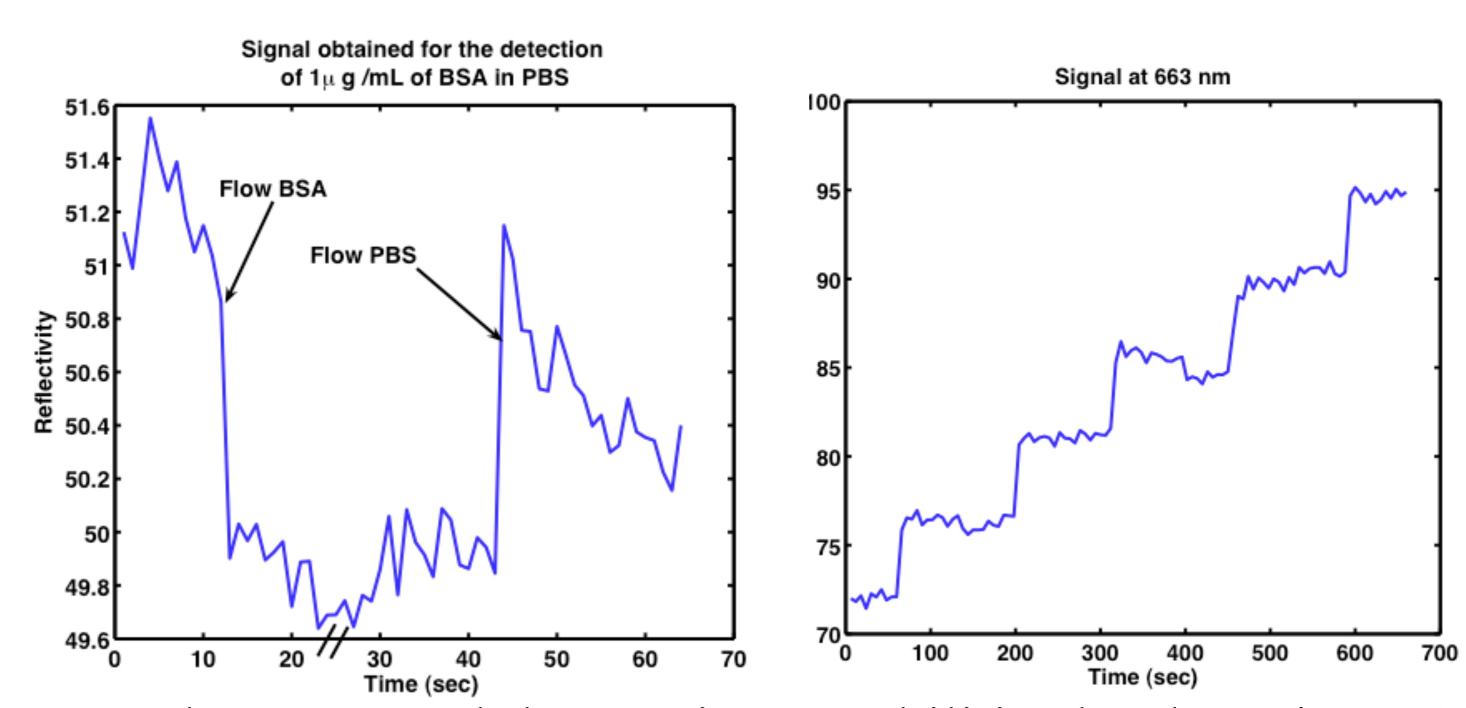
- We measure the reflectivity of a thin metallic layer versus the angle of incidence and the wavelength.
- SP propagation can be observed by measuring the position of the minima of reflectivity.
- When nanostructures are placed on the surface, the SP propagation is modified.

SP band gap observation



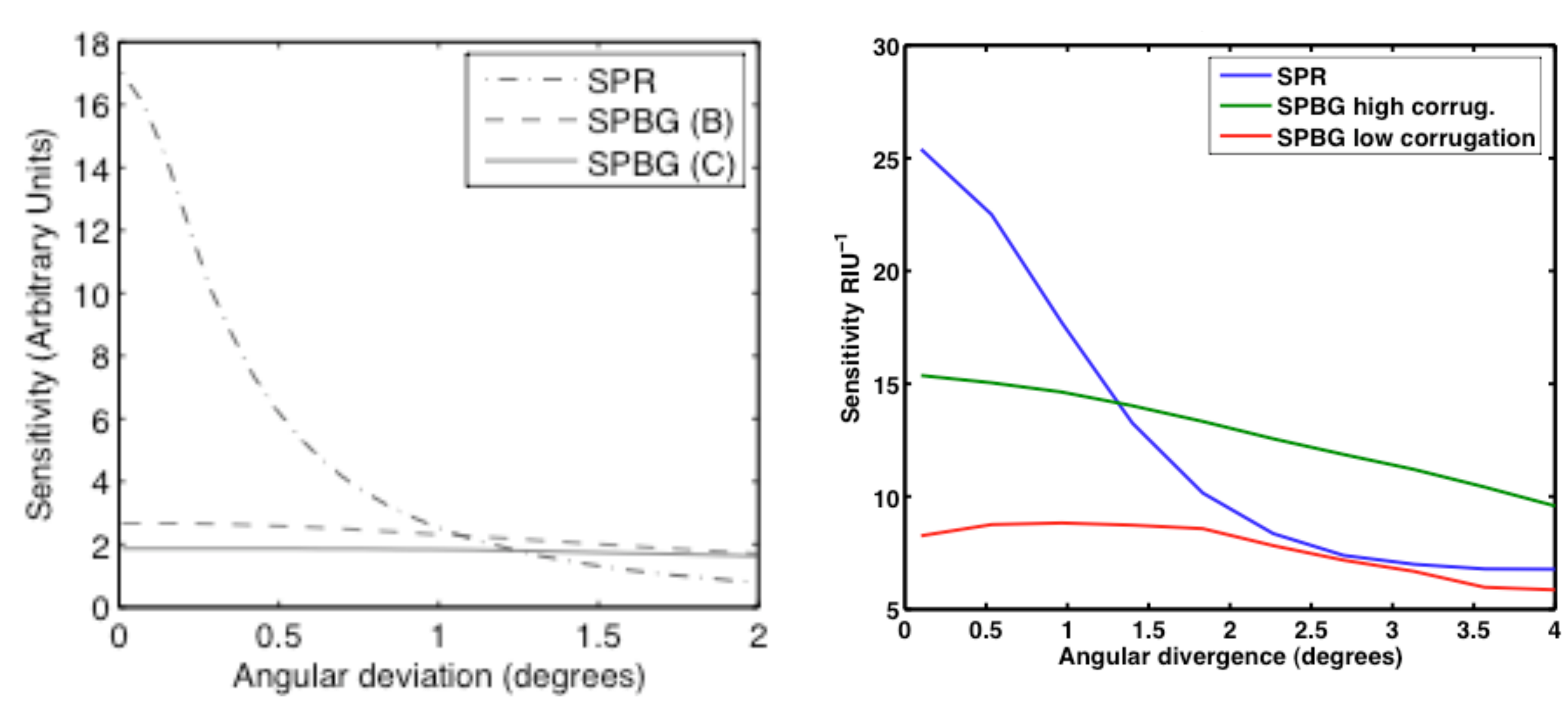
- The blue area (intensity minima) corresponds to SP excitation.
- The band gap is clearly visible around 550 nm.

Sensing results



- We demonstrated the sensing capabilities by detecting BSA binding on the surface (Left) and by changing the bulk optical index using glycerol (Right).

Sensor performance



Numerical *Experimental*

- We experimented with different configurations of the sensor and measured the sensitivity versus the angular divergence.
- The experimental results show that our technique can hedge the negative effect of the corrugation on the sensitivity, which was cannot be observed numerically.

Two papers and a patent have resulted from this work