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Introduction

The project aims to develop an electrochemical sensor to detect the concentration of a biomolecule through change in impedance with change in concentration of analyte. It is proposed that when a biomolecule is close to the Localized Surface Plasmon Resonance (LSPR) region, it tends to vibrate energetically, changing the impedance. The sensor will measure the change in impedance through Electrochemical Impedance Spectroscopy (EIS). The surface of the sensor is enhanced by two nanostructure pyramids fabricated through two photon polymerisation additive manufacturing using Nano scribe GT-2 System for greater surface area and plasmonic interaction.

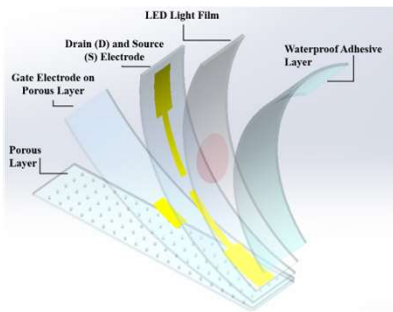


Fig.1: Schematic Image of the proposed flexible sensor

Methodology

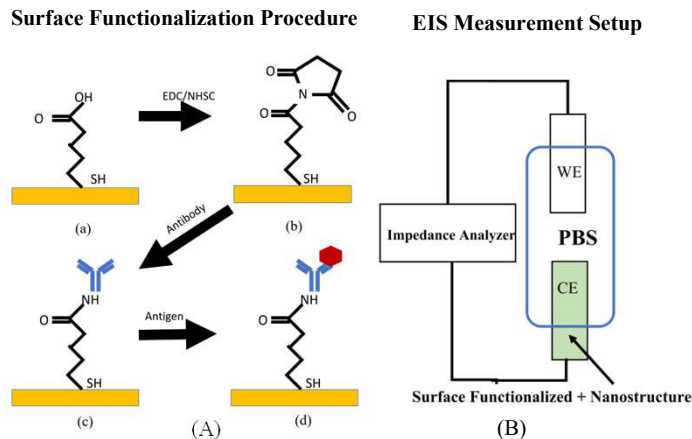


Fig.2: (A) Schematic diagram of functionalization of the gold surface with antibody (a) formation of tightly packed using thio compound (b) functionalization with carbodiimide and succinimide chemistry (c) reaction with antibody (d) reaction with antigen (B) EIS schematic setup

Results

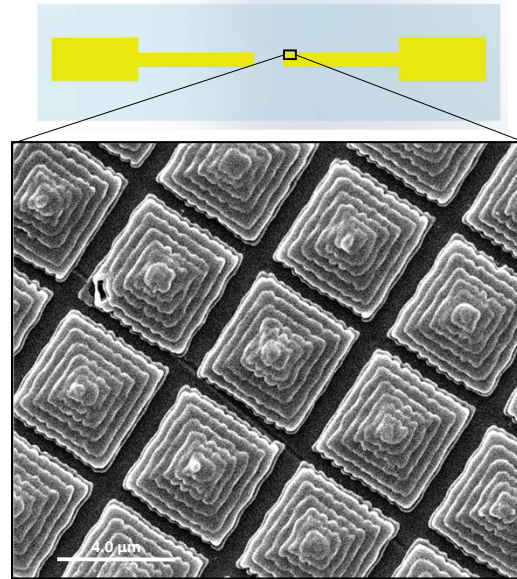


Fig.3: Schematic of the sensor design and Scanning electron microscope image showing the nanopyramids with 4.0 μm x 4.0 μm and height of 4.5 μm as a base

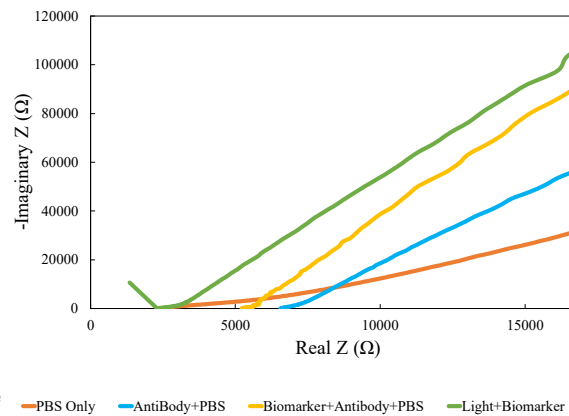


Fig.4: Nyquist plot to show change through the surface functionalization process

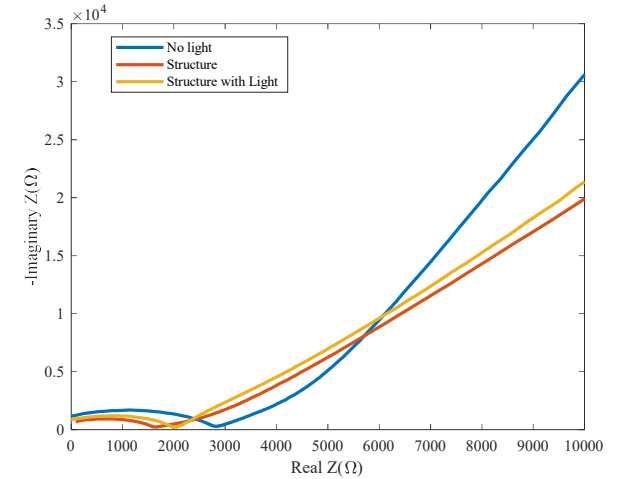


Fig.5: Nyquist plot to show the difference between presence and absence of structure and with and without light condition

Discussion

The preliminary experiment data shows a steady increase in impedance as the surface of the sensor is functionalized. The data from the experiment can be used to calibrate the sensor for the experiment in presence of specific wavelength. The structure enhancement has caused the impedance to decrease while the presence of light is increasing it as seen in figure 6.

Conclusion

The preliminary experiment shows significant change in impedance when the sensor is in presence of light. Further refinement in experiment methods and repeatability of the experiment will be required for a definite correlation.

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