POROUS SILICON BASED NANOTECHNOLOGY FOR OPTICAL BIOSENSORS

S. Mariani[1], S. Surdo[2], M. Minunni[1], G. Barillaro[2]
[1]Dipartimento di Chimica “Ugo Schiff” and CSGI, Università degli Studi di Firenze, Via della Lastruccia 3, 50019, Sesto F.no (FI), Italy
[2]Dipartimento di Ingegneria dell’Informazione, Università di Pisa, Via G. Caruso 16, 56122 Pisa (PI), Italy

Porous silicon (pSi) is an advanced material that has been often employed in highly sensitive optical transducers and label-free biosensors for a wide range of applications (i.e. biomedical diagnostics, environmental monitoring, veterinary and food quality control) [1-4]. In particular, rugate filters are nanostructured resonant optical structures based on porous silicon, which have been often exploited in biosensing thanks to high sensitivity, low limit of detection, and low-cost and straightforward fabrication.

In this work we study the immunoaffinity interaction between Bovine Serum Albumin (BSA) and its specific antibody anti-BSA as model system for immunosensing applications of rugate filters as label-free transducers.

Porous silicon rugate filters with high-reflectivity and good reproducibility operating in three specific regions of the visible spectrum (namely, red, green, and blue) are fabricated by electrochemically etching of p++ silicon wafer in HF-ethanol solutions using computer-controlled sinusoidal current-density waveform. Rugate filters features good Q factors (about 30), thus envisaging that high sensitivity can be achieved for biosensor applications.

An immobilization procedure using APTES (3-Aminopropyl)triethoxysilane) as linker is optimized to covalently bind biomolecules to the nanostructured pSi surface. BSA is then covalently immobilized on the aminosilanized surface for a competitive immunoassay with BSA antibody. Wavelength shift of the rugate reflectivity peaks after each optimization step are monitored.

The optimized model can be further transferred to other interaction systems involving protein immobilization for future development of portable and high sensitive devices employable in many fields.

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