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Ultrasensitive and selective impedance biosensing platform based on nanoporous silicon oxide

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Rapid and sensitive identification of the presence of various biomarkers and pathogen in a patient's blood sample is extremely important for accurate and low cost diagnosis. Electrochemical immunosensors have recently aroused much interest for detection in clinical diagnostic situations as they are sensitive and do not need secondary labels. However, the detection limit and selectivity achieved in real physiological samples is not satisfactory. Nanoporous silicon oxide(NPS) impedance biosensors with ordered nanopores have been demonstrated as highly sensitive and selective platform for label free electrical detection of biomolecules through an unique frequency dependent sensitivity characteristics. Further, the measured impedance signal is usually submerged in noise arising from the random movement of ions at the interfaces, the dynamics of the antigen-antibody binding and the intrinsic device noise owing to carrier fluctuations. For nanoporous silicon oxide sensors, the device noise due to the silicon oxide columns is primarily capacitive in nature and is expected to appear at high frequency unlike the low frequency conductance noise of silicon nanowires. Thus the specific antibody-antigen binding events may be separated from the other noise sources in such sensors through the spectroscopy analysis of the fluctuations which may eventually reduce the problem of ultrasensitive detection in blood. Performing noise spectroscopy analysis at the peak frequency of these sensors has enabled sub-femtomolar detection of Hep-B virus in blood down to 0.05 fg/ml which is the most sensitive report till date, using label free technique. Thus NPS platform has the potential to mature into a commercial biosensor.

Biography

Chirasree Roy Chaudhuri has completed her PhD from Jadavpur University, India in 2007. Her research interests include design and development of ultrasensitive electrochemical biosensors and real time monitoring of cellular phenomena by impedance spectrsocopy of nanopatterned substrates. She has published around 100 papers in international journals and conference proceedings and has received Young Scientist Award from National Academy of Engineering and National Academy of Science, India. She is a senior member of *IEEE* and an Associate Editor of the *IEEE Sensors* journal.

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