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Nanostructured porous silicon oxide - a unique device for ultrasensitive label free impedance biosensors

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Various nanostructures like nanowires, nanotubes and nanopores have been extensively explored for label free conductance type biosensors and also for detection of a single molecule in synthesized solutions. However, their major limitation is that the detection limit of biomolecules in physiological fluids like blood is only in the range of few picomolar (pM).There have been several attempts to push down the detection limit by performing the noise analysis of the conductance fluctuation. But it has failed to differentiate the noise originating due to the specific antibody-antigen binding kinetics from the large magnitude of the device noise for fM or sub fM concentrations. This talk explores the physical origin behind this phenomenon and introduces nanostructured porous silicon oxide as a novel device for ultrasensitive detection. The device is fabricated by electrochemical etching of silicon followed by annealing treatment for coalescence of small pores below 10 nm diameter (usually formed on the top) and subsequent thermal oxidation. This ensures stable and reproducible impedance measurements. Experimental observations reveal the unique presence of resonant peak in the frequency dependent characteristics only in the presence of specific antigen. Further this peak is also concentration dependent and combining the noise analysis at the resonant frequency has enabled the selective detection of Hep-B virus in blood samples down to 1 fM concentration. The physics behind these observations have been interpreted by coupling stochastic modeling with modified Poisson Boltzman statistics.

Biography

Chirasree Roy Chaudhuri has completed her PhD in 2007 from Jadavpur University, India and is presently an Assistant Professor in Department of Electronics and Telecom Engineering, IIEST Shibpur, India. Her fields of research interest are development of selective electrical biosensors, understanding the physical mechanisms for sub-femtomolar detection and measurement of biophysical properties of cells through distributed models. She has received the Young Scientist Award from National Academy of Science, India and Women Excellence Award from Department of Science and Technology, Govt. of India and has published around 60 papers in peer reviewed journals and proceedings.

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Preparation and characterization of strontium aluminate phosphor

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Present paper reports synthesis of $SrAl2O4:Eu^{2+}$, Dy^{3+}, thermoluminescence, photoluminescence and long persistent nano phosphor. The sample prepared by combustion method using urea as reducer at 650°C. Samples were characterized by Absorption spectra, XRD and SEM. Crystallization, particles size and luminescence properties of the sample have been investigated. It was found' that average size of particles is nano to micrometer. The TL efficiency increases by consecutive heating and irradiation and attains optimum value for certain temperature because there might be a significant probability that once a number of electrons are in a delocalized state on the conduction band they may be recombined or trapped at a deep trapping level associated with TL emission. The emission spectrum consists of broad bands with the peaks at 520 nm, respectively. The persistent luminescence phenomenon involves the formation of traps followed by thermal bleaching of traps and the characteristic Eu^{2+} emission as well as the nature of traps and a persistent time longer than traditional sulfide phosphors.

Biography

D S Raghuwanshi has completed his PhD from Rani Duragawati University Jabalpur, Madhya Pradesh, India. He is currently working as an Associate Professor in Department of Applied Physics, SSTC, SSGI, Bhilai, Chhattisgrah, India. He has published six papers in reputed journals and is doing research work in the field of solid state and material science.

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