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Low-Cost Solution Processed IGZO Thin Film Transistor for Protein Sensing Application

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Abstract

The solution processed thin film transistors have wide range of applications in research and technology in flexible displays, low power electronics, circuits and sensors due to the advantages of low leakage currents, high surface homogeneity, adaptability to various process, reproducibility and high reliability. The TFT applications are extended to biosensing and for biochemistry analysis due to its ability to detect molecules, ions, peptides, lipids, oligonucleotides and DNA. The need of low cost biosensing, direct and rapid detection, has attracted thin film transistors towards biosensing due to their high sensitivity sensing, miniaturization, low cost fabrication and room temperature processing. TFT biosensors can easily detect tiny electrical charge difference from bio molecules with very high sensitivity current or voltage and the same transistor can be used for signal readout. The low cost and low operating voltage a-IGZO TFT with top gate top contact architecture (TGTC) is processed with silver as top gated material(screen printed) as sensing layer for protein detection with various concentrations of streptavidin. APTES is functionalized on silver gate followed by functionalization of Sulfo-NHS biotin for sensing various molar concentrations of streptavidin as a protein sensor. The operating voltage is almost $V_{gs}= 5V$ and $V_{ds}=2V$. TFT exhibits the electrical properties of, $V_{th}=0.66V$, $I_{on}/I_{off}=0.9 \times 10^6$ with mobility of $0.15 \text{ cm}^2/v\text{-s}$.

Keywords: a-IGZO TFT, protein Biosensing, streptavidin sensor, Topgated Biosensor