Growth of ZnO Nanowire Arrays on Various Substrates for Enhanced Glucose Sensing

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Abstract. This study explores the potential of zinc oxide (ZnO) nanowires grown on various substrates for glucose sensing applications. The primary aim is to evaluate the electrochemical performance of these nanowires for non-enzymatic glucose detection, focusing on optimizing sensitivity, reproducibility, and selectivity. Initial experiments using a phosphate-buffered saline (PBS) solution demonstrated that the ZnO nanowire-based system can detect glucose.

Substrate selection plays a critical role in determining the morphology and alignment of ZnO nanowires, which directly impacts sensor performance.

Recent studies have demonstrated the advantages of using silicon (Si) substrates for the growth of ZnO nanowire arrays, where the high-density nanostructures significantly enhance the electroactive surface area, improving sensitivity for glucose detection [1,2].

Substrates like indium tin oxide (ITO) showed promise by delivering more ordered nanowire arrays, while gallium arsenide (GaAs) produced more complex growth morphologies [3,4], with potential applications in other analytical areas. GaAs bulk substrates, including GaAs nanowire arrays, offer advanced properties such as higher electron mobility and unique surface chemistry. GaAs substrates allow for more complex growth of nanowires and improved electronic properties, suggesting potential for even greater

performance improvements in glucose sensing compared to conventional Si substrates.

Further work is needed to refine the sensing capabilities and achieve greater selectivity for glucose in complex biological environments, building on previous studies on the influence of nanowire morphology on electrochemical performance, such as those on porous semiconductor compounds [5]. Additional studies will focus on improving system performance and exploring new methods to enhance glucose detection.

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