PREFACE

Copper oxide as a nanostructure is more stable for electro-analysis than copper as an element. Copper oxide nanostructure has been widely used electrode as glucose sensors. Copper oxide nanowire has been used with the rapid advancement in enzyme-less glucose detection. A chain of CuO nanostructure has also been widely planned and fabricated to increase their intrinsic characteristics and performances in glucose sensors, including nanospheres, nanowires, nanorods, and nano flower-like structures.

Copper oxide nanowire with gold nanoparticles gives suitable sensing towards glucose detection by the electrochemical method. Moreover, this thesis includes glucose detection through electrical methods also. Extended gate-field effect transistors (EGFET) have been used for glucose detection through the electrical method. This thesis covers five chapters which are briefly discussed in the following.

Chapter-1 introduces the enzymatic and non-enzymatic glucose sensors. Metal oxide-based semiconductors have been studied for non-enzymatic glucose sensors. This chapter also introduces the different CuO nanostructures for glucose sensing applications. Moreover, this chapter also demonstrates conduction mechanisms of glucose sensing, different thin film characterization techniques, and their importance for sensing applications. A detailed literature survey followed by the scope of the existing thesis has been finally outlined in this chapter.

Chapter-2 reports glucose sensing through gold nanoparticle decorated CuO nanowire electrode. In this chapter, Glucose has been sensed in different concentrations of NaOH. At 0.1M NaOH concentration, electrode performance was excellent in terms of

sensitivity, while at (0.5M and 1M NaOH) solution, electrode performance was good in terms of linearity. Glucose sensing performance has been analyzed by its reproducibility, reusability, and stability tests.

Chapter-3 presents a CuO NWs based working electrode for glucose sensing application. In this work, CuO NWs electrode connected at the gate of the Commercial FET. The working electrode has been immersed in the PBS solutions (pH~7.4) along with a reference electrode Ag/AgCl. The most crucial benefit of this arrangement is that separately connected transistors part from the sensing membrane can prevent the transistors part from the chemical damage. Further, the fabrication requirement of the sensing electrode part gives us the freedom to develop various sensing electrodes with different sensing materials by using different fabrication methodologies for different sensing applications. CuO NWs electrode-based EGFET has been explored for glucose sensing applications for the first time without using any enzyme or organic receptors.

Chapter-4 investigates the glucose-sensing characteristics of the EGFET using ZnO nanorods decorated with CuO NPs on FTO as a substrate. The surface and structural morphologies of the ZnO nanorods modified with CuO NPs based electrode has also been studied. This EGFET based glucose sensor gives high sensitivity and good linearity. Good repeatability, reproducibility, and stability confirm that this electrode is quite reliable for glucose sensing applications.

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