INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

The demand for inexpensive, miniaturized, reliable, and portable sensors is ever increasing in the present time. In this regard, nanomaterial enabled sensors are considered promising candidates for numerous sensing applications due to their distinct physical and chemical attributes. The present thesis explores the salient features of nanomaterials by incorporating them in sensor technology for various applications. The thesis aims to develop affordable, compact, and robust nanomaterial enabled chemiresistive sensors for various sensing applications, including healthcare, food processing and agriculture, and environmental monitoring.

In this research work, various chemiresistive sensors have been developed by incorporating surface modified multiwall carbon nanotubes (MWCNTs) and metal based nanomaterial composite as the sensing material. In this regard, covalent and noncovalent functionalization techniques have been explored to attach suitable functional groups on the surface of MWCNTs for highly sensitive and selective applications. In one research work, the surface of MWCNTs has been modified with thiol functional groups for urea sensing applications in aqueous solution and raw milk samples. In another work, poly(diallyldimethylammonium chloride) solution (PDDA) has been attached to MWCNTs surface using a noncovalent functionalization approach to form MWCNT-PDDA composites. These MWCNT-PDDA composites have been explored for room temperature carbon monoxide gas sensing applications. A section of research has also demonstrated the synthesis of metal oxide heterojunction composite, where molybdenum disulfide-copper oxide (MoS_2-CuO) nanocomposite has been explored for acetone gas sensing application. A section of the research has also demonstrated the development of a paper based enzymatic chemiresistor for point-of-care (POC) detection of ethanol in human breath. The sensor is developed on a biodegradable paper substrate with alcohol dehydrogenase (ADH) modified MWCNT composite as the sensing material. In addition, the sensor is also integrated with an electronic circuit to develop proof-of-concept prototypes for the POC detection of ethanol in human breath.