Piezoelectric P(VDF-TrFE) micro cantilevers and beams for low frequency vibration sensors and energy harvesters

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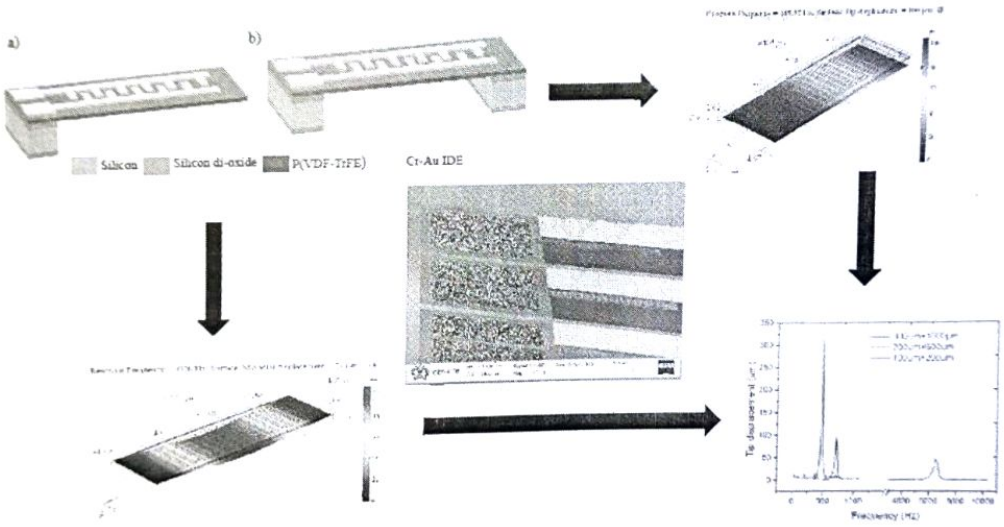
Graphicala bstract



Highlights

- A novel MEMS based Si bulk micromachining process has been developed to fabricate P(VDF-TrFE) micro-cantilevers and beams successfully for the first time.
- Design and simulation of micro-cantilevers and beams were carried out using Comsol Multiphysics.

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Pore size tuning of Nafion membranes by UV irradiation for enhanced proton conductivity for fuel cell applications

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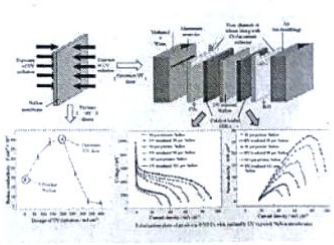
HIGHLIGHTS

- Pore size tuning of Nafion membranes is achieved by irradiation with UV rays.
- Optimum dose of UV rays on Nafion results in enhancement of proton conductivity.
- Microelectromechanical systems technology is used to define flow channels in silicon.
- UV exposed Nafion is tested in passive direct methanol fuel cells as a platform.
- Durability test of direct methanol fuel cells with UV exposed Nafion is carried out.

GRAPHICAL ABSTRACT



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ABSTRACT

The influence of optimal ultraviolet irradiation of Nafion membranes in enhancing proton conductivity and performance of passive micro-direct methanol fuel cells with silicon micro-flow channels is investigated for the first time. Initially, Nafion membranes are irradiated with different doses of ultraviolet radiation ranging within 0–400 mJ cm^{-2} and their water uptake, swelling-ratios, porosity, and proton conductivities are measured using standard procedure. Results show that there is an enhancement in proton conductivity with an optimal dose of 198 mJ cm^{-2} ultraviolet radiation. This enhancement is due to optimum photo-crosslinking of $-SO_3H$ species resulting in maximum pore-size which

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Power enhancement of passive micro-direct methanol fuel cells with self-sulfonation of P(VDF-TrFE) copolymer during lamination on Nafion membrane

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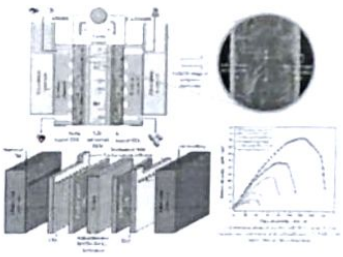
HIGHLIGHTS

- Hydrophobic PEM is achieved by P(VDF-TrFE) lamination of Nafion.
- The lamination results in reduction of water uptake and methanol permeability of PEM.
- Self-sulfonation of P(VDF-TrFE) is achieved during lamination on Nafion confirmed by FTIR.
- Proton conductivity is introduced in the lamination due to self-sulfonation.
- Significant enhancement in power density of passive μ-DMFCs with laminated PEMs.

GRAPHICAL ABSTRACT



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ABSTRACT

Among the various advances that have taken place in fuel cells, efforts to reduce the methanol crossover and thereby increase fuel cell performance are important. One method by which crossover can be reduced is through introduction of hydrophobic surface on membrane which reduces the entry of methanol into the membrane. Here we show that coating of poly(vinylidenefluoride-trifluoroethylene) on Nafion results in reduction in crossover due to the introduction of hydrophobicity on the surface of the composite membrane which, in turn, improves the fuel cell performance. Further, FTIR results have

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Investigation on the sulfurization temperature dependent phase and defect formation of sequentially evaporated Cu-rich CZTS thin films

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Thin film photovoltaics
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Secondary phases

ABSTRACT

We report synthesis of Copper Zinc Tin Sulfide (CZTS) thin films using sequential evaporation technique. The as-deposited films were subjected to various sulfurization temperatures ranging from 520 °C to 640 °C. This paper presents a detailed analysis of temperature dependent phase and defect formation in Cu-rich off-stoichiometric CZTS thin films. CZTS thin films moved from P-type to C-type with decreasing Cu/Zn disorder and defect concentration with increasing sulfurization temperature. The resulting films showed less off-stoichiometry in contrast to initial choice of intended off-stoichiometry exhibiting the structural flexibility within the compositional limits. Despite being off-stoichiometric, all the samples exhibited the tetragonal CZTS phase with preferred orientations. Raman analysis showed the disappearance and reappearance of secondary phases with increasing sulfurization temperature. EDS analysis suggested that composition of the films moved towards better stoichiometry till 580 °C before deteriorating again. Composition and lattice parameter values suggested Cu-rich off-stoichiometric nature of sulfurized CZTS thin films. AFM study showed dependence of roughness with sulfurization temperature. Band gap was obtained in the range of 1.28 eV to 1.48 eV from UV–Vis spectroscopy measurement. PL analysis revealed the asymmetric shape and blue shift of the peaks. Band-to-tail recombination becomes pronounced with increase in sulfurization temperature. XPS analysis showed elements are in expected oxidation states.

1. Introduction

The advancements in second generation photovoltaic materials such as Cadmium Telluride (CdTe) and Copper Indium Gallium Selenide (CIGS) have captured a notable portion in the photovoltaic (PV) market due to low cost and low material consumption further complimenting their power conversion efficiencies. From the view of techno economic concern, the idea of replacing toxic and scarce elements has led to the discovery of earth abundant, low-cost chalcogenide kesterite materials commonly known as Copper Zinc Tin Sulphide/Selenide (CZTS/Se). Serious scarcity of raw materials essential for the CdTe and CIGS technologies pose a challenge to meet the terawatt (TW)-scale future energy demand. Recently, the European Commission listed indium, gallium and tellurium as Critical Raw Materials (CRM). This would further increase the cost of the raw materials required for CdTe and CIGS technologies. Hence, an alternative partial or total CRM free substitution is necessary in the photovoltaic technologies where CZTS/Se emerges as an answer, providing cost-effective thin film absorber material (Giraldo et al., 2019). The estimation of theoretical efficiency of CZTS/Se system is around −33% with respect to Shockley–Queisser limit. CZTS and CZTSSe have reached an efficiency of 11% and 12.6% respectively, the highest lab module power conversion efficiency reported so far. In order to make it marketable, these materials should cross the mark of 15% conversion efficiency at least providing a sufficient room to improve the efficiency (Abermann, 2013; Delbos, 2012).

Significant research is currently going on in understanding the complexity, structural and compositional stability on the off-stoichiometric kesterites. The off-stoichiometric kesterites have been categorized based on their Cu and Zn composition (Table 1). Researchers followed both theoretical and experimental approach in understanding the implications of these off-stoichiometries on the device performance. The strong correlation was experimentally found between composition

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Solid State Technology

A Design and Implementation of Adiabatic Logic on Low Power Application Circuits

Praveen J , Bhuvanesh M , BS Nagarakshitha , Bhanupriya HK , Ananda Kumar K

Issue
Vol. 63 No. 5 (2020)

Section
Articles

Abstract

The relevant decision of flip-flops topologies is of fundamental significance in the structure of
Very Large Scale Integrated (VLSI) and Complementary Meta-Oxide Semiconductor (CMOS) circuits.
Breaking down the conduct of existing customary flip-flops and picking the best flip-flops for the
predetermined application is a fundamental issue to finish the requirement low power circuit. The Dflipflops is the most important block in synchronous counters with excessive power utilization influence the
general effectiveness of the system. This power dissipation can be diminished by utilizing the adiabatic
technique. In this paper existing [1-5] flip-flops are designed first for which delay, power and area are
calculated. Then these existing flip-flops are newly proposed by using an adiabatic technique for which
again delay, power and area are calculated. The design of these existing and proposed is designed by using
Cadence Virtuoso Schematic Editor and Analog Design Environment (ADE) for 180nm technology with a
supply voltage of 1.8V and 100MHz frequency. The existing D-flip flop

Solid State Technology

Design and Fabrication of Ammonia Gas Sensor Using Electrospinning Method for Industrial and Medical Applications

Praveen J , Rasika Patil , Rohini Halloli , Sahana MG , SheelaGolasangi

PDF

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Section
Articles

Abstract

Ammonia (NH3) is a very injurious gas, the part of nitrogen along with the mixture of other
gases is present in our day today lives. Therefore, detection of greatly sensitive ammonia sensors plays an
important role for environmental protection and also in human health and care. So in order to sense low
concentrations of ammonia (<=50ppm) making use of conventional means at room temperature is required.
Tin monoxide (SnO) is a member of metal monoxide, this has paid much attention to its low cost,
environmental friendly and higher stability. When made comparison with other non-oxide ammonia

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Solid State Technology

Design and Implementationof Low Power VLSI FinFET Dynamic Latch Comparator for ADC Application

Praveen J , Raziya Banu , Rashmi KB , Varshini MN , Soundarya NA

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Section
Articles

Abstract

— One of the most significant circuits among analog integrated circuits is the comparator. The
significant issue during designing of the comparator is power dissipation. Analyzing the performance of the
existing conventional comparators, for the application of Analog to Digital Converters (ADC) like flash
ADC. The power issues can overcome by using the proposed comparators which uses Fin Field Effect
Transistor (FinFET) technology. The FinFET technology has the remarkable gate control feature towards the
region of the channel. In this paper, at first the four existing conventional dynamic latch comparators are
designed for which the power is calculated. Then these existing conventional dynamic latch comparators are
upgraded into the proposed structured utilizing FinFET innovation for power is calculated, since power is a
significant worry in the comparators. These existing conventional comparators and the proposed
comparators using FinFET are simulated and designed using the cadence virtuoso version 6.1.5 for GPDK
180nm CMOS technology.The conventional dynamic latch comparator

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Solid State Technology

A Review: Design And Fabrication Of Gas Sensor Using Sol-Gel Spin Coating Technique For The Detection Of Ethanol

Praveen J , Sangeetha S V , Shilpa N , Samarth Jain , Sangamesh S K

PDF

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Abstract

The sensor is an important part of daily activity. The sensor has already been commonly used for a variety of various applications such as medical technology, aerospace, etc. In manufacturing, on the other hand, the devices are used to analyze certain ambient parameters including temperatures, humidity, etc. Gas sensors are one of these groups, used to detect the existence of gases. Most factories manufacture ethanol as one of their bi-products. Ethanol induces skin inflammation and triggers asthma to people employed in business, and drug misuse influences the actions of consumers that intensify society's crime and injuries. The largest proportion of ethanol is present in alcoholic drinks. Therefore, it is important to keep track. Because of the tremendous motivation in nanotechnology over time, gas sensors are chosen to identify gases. In the paper, a survey has been done on various gas sensors and

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Role of UV irradiation of Nafion membranes on ionic groups responsible for proton conduction and mechanical strength: A FTIR spectroscopic analysis

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Optimal UV dosage
polytetrafluoroethylene (PTFE)

ABSTRACT

This work presents an evidence of why proton conductivity of Nafion increases with increase in UV-radiation dosage and drops beyond ultraviolet radiation dosage of 198 mJ cm^{-2}. FTIR spectroscopic analysis is used to analyse the shifting of the peaks of groups responsible for proton conduction (i.e. sulfonic acid ($-SO_3H$) and hydronium (H_3O^+) ions) of Nafion irradiated by various dosages of UV-radiation. The analysis showed that crosslinking of $-SO_3H$ increases up-to UV-radiation dosage of 198 mJ cm^{-2}. Beyond this optimum UV-radiation dosage the chain-scission of these groups takes place. On the other hand, UV-radiation has significant degradation effect on H_3O^+. FTIR spectra of H_3O^+ show that even with slightest dosage of UV-radiation, chain-scission takes place. Further, the effect of UV-radiation of Nafion on the groups responsible for providing mechanical strength, i.e. $-CF_2$ is also analysed using FTIR spectroscopy. The analysis showed that the intensity of transmission spectrum of $-CF_2$ increases up-to UV-radiation dosage of 198 mJ cm^{-2} and drops beyond this dosage indicating that there is a possibility of enhancing the mechanical stability up to this dosage. These analysis show that optimum dose of UV-radiation is an effective tool for enhancing the proton-hopping mechanism and thereby, proton conductivity, and also the mechanical stability of Nafion.

1. Introduction

Nafion membranes are resins of perfluorinated sulfonic acid developed by the E. I. DuPont Company. They find their uses in many areas like energy conversion devices which include redox flow batteries, electrolytes in devices for detection of humidity in a corrosive environment [1], gas separation [2] etc. In addition to these, Nafion finds its applications in proton exchange membrane fuel cells (PEMFCs) [3]. PEMFC is an electrochemical device that uses hydrogen-rich fuels (such as methanol, hydrogen etc.) together with oxygen to generate electricity and heat [4,5]. Nafion membrane has attracted attention because of its widespread usage in PEMFCs. Several studies on its microstructure and properties have been conducted using numerous approaches over the last few years [6]. Nafion membrane is a type of cation exchange membrane which contains groups with negative charge, like $-SO_3^-$, bonded with the backbone of membrane and thereby, allows the cations to pass but block anions [7]. Nafion membrane has a backbone which is hydrophobic and contains polytetrafluoroethylene (PTFE) i.e. $-CF_2-$ that provides mechanical strength and heat resistance to Nafion [8]. This hydrophobic chain terminates with sulfonic acid group ($-SO_3H$) which is hydrophilic and can conduct protons while blocking the electrons [9,10]. This sulfonic acid group, in other words, has affinity to protons and thus aids the movement of protons through it while the electrons are blocked [9,10]. Apart from the sulfonic acid group, the water content in the membrane also impacts the movement of protons [10]. Further, these ionic groups have affinity to water resulting in the absorption of water by polymer leading to the hydration of polymer. It is also known that optimal hydration of membrane is required for conduction of protons along with its mechanical stability and durability [11].

Proton conduction is important in PEMs and is typically the first feature considered when assessing membranes for possible use in PEMFCs. The molecular level protonic transport in hydrated polymer matrices is usually defined on the basis of one of the two major mechanisms: "proton hopping " or "Grotthus mechanism" and "vehicular mechanism" (similar to diffusion) in which water molecule is used as a vehicle [12–14]. Proton hopping mechanism takes place in Nafion where proton hops from one hydrolysed site ($-SO_3H$ groups) to another site through the membrane. As per tri-phase tubular model, Nafion consists of an outer flexible polymer backbone, a hydrophilic layer i.e.

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Methanol crossover reduction and power enhancement of methanol fuel cells with polyvinyl alcohol coated Nafion membranes

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ABSTRACT

This paper presents the effect of polyvinyl alcohol (PVA) coated Nafion membranes on their water uptake, swelling and proton conductivity for various PVA coating thicknesses. These studies show that the optimum coating thickness of PVA on Nafion is 2 μm. Methanol permeation studies show that 2 μm thick PVA coating forms a barrier for methanol and significantly reduces methanol permeation through the membranes. Further, passive methanol fuel cells are tested with 2 μm thick PVA coat on Nafion as proton exchange membranes and their polarization plots show a significant enhancement in power as compared to the methanol fuel cells with pristine Nafion due to reduction in methanol crossover.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Laser Deposition: Nanostructures, Hetero-structures and 2D layers.

1. Introduction

Methanol fuel cells (MFCs) have received attention over the last decade because of their high efficiency and high power density generation capacity [1–3]. MFCs have provision for miniaturization/scaling laws [4], and MFC is therefore, an evolving technology [5,6]. They consume methanol as fuel together with oxygen to generate electrical power and hence, they are considered as electrochemical devices. MFCs are fuel cells that use Nafion proton exchange membrane (PEM). Pt-Ru nanoparticles aid the splitting of methanol at anode into carbon-di-oxide, electrons and protons [7]. The electrons travel through the outer electrical circuit while the protons diffuse through the PEM to the cathode and generate electrical power. At the cathode, e^-, H^+ and O_2 combine to generate water with Pt acting as nano-catalyst [8].

The most important membrane presently used in FCs as PEMs are perfluorosulfonic acid (PFSA) membranes (such as Nafion); Nafion has excellent mechanical strength in addition to excellent stability. They have backbone of hydrophobic fluorocarbon chains along with hydrophilic sulfonic acid groups [9]. These hydrophilic groups contribute to proton conductivity. The conductivity of the protons will be small with low water content and the membranes with hydrophilic groups having higher water content will have higher proton conductivity [10,11]. On the other hand, the membrane will be mechanically compromised by excess hydrophilic groups [12]. Hence, an optimal density of hydrophilic groups should be present in the PEM along with their optimum crosslinking density [13]. When the PEM absorbs water, hydrophilic domains swell facilitating the protons to conduct. There has been extensive study on how water sorption affects proton conductivity of nafion [14–23]. Hence, by studying the hydration of PEM, proton conductivity is evaluated followed by the power density of MFCs. Water soluble polymers (WSPs), like Poly (styrene sulfonic acid), chitosan (CS), Poly (vinylpyrrolidone) (PNVP), poly (ethylene glycol) (PEG), poly (2-acrylamido-2-1-propanesulfonic acid) (PAMPS), polyvinyl alcohol (PVA), etc, have lately become progressively interesting to both academia and industry, as it is possible to use them in soft material applications [24–27]. WSPs that are hydro-

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ABSTRACT

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Power enhancement of passive micro-direct methanol fuel cells with self-sulfonation of P(VDF-TrFE) copolymer during lamination on Nafion membrane

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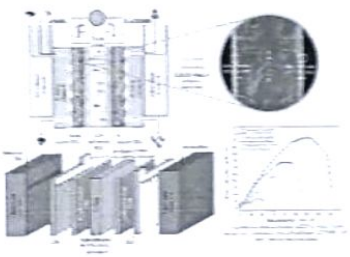
HIGHLIGHTS

- Hydrophobic PEM is achieved by P(VDF-TrFE) lamination of Nafion.
- The lamination results in reduction of water uptake and methanol permeability of PEM.
- Self-sulfonation of P(VDF-TrFE) is achieved during lamination on Nafion confirmed by FTIR.
- Proton conductivity is introduced in the lamination due to self-sulfonation.
- Significant enhancement in power density of passive μ-DMFCs with laminated PEMs.

GRAPHICAL ABSTRACT



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ABSTRACT

Among the various advances that have taken place in fuel cells, efforts to reduce the methanol crossover and thereby increase fuel cell performance are important. One method by which crossover can be reduced is through introduction of hydrophobic surface on membrane which reduces the entry of methanol into the membrane. Here we show that coating of poly(vinylidenefluoride-trifluoroethylene) on Nafion results in reduction in crossover due to the introduction of hydrophobicity on the surface of the composite membrane which, in turn, improves the fuel cell performance. Further, FTIR results have

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Pore size tuning of Nafion membranes by UV irradiation for enhanced proton conductivity for fuel cell applications

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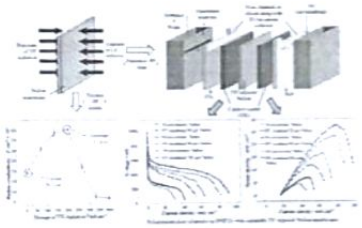
HIGHLIGHTS

- Pore size tuning of Nafion membranes is achieved by irradiation with UV rays.
- Optimum dose of UV rays on Nafion results in enhancement of proton conductivity.
- Microelectromechanical systems technology is used to define flow channels in silicon.
- UV exposed Nafion is tested in passive direct methanol fuel cells as a platform.
- Durability test of direct methanol fuel cells with UV exposed Nafion is carried out.

GRAPHICAL ABSTRACT



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ABSTRACT

The influence of optimal ultraviolet irradiation of Nafion membranes in enhancing proton conductivity and performance of passive micro-direct methanol fuel cells with silicon micro-flow channels is investigated for the first time. Initially, Nafion membranes are irradiated with different doses of ultraviolet radiation ranging within 0–400 mJ cm^{-2} and their water uptake, swelling-ratios, porosity, and proton conductivities are measured using standard procedure. Results show that there is an enhancement in proton conductivity with an optimal dose of 198 mJ cm^{-2} ultraviolet radiation. This enhancement is due to optimum photo-crosslinking of $-SO_3H$ species resulting in maximum pore-size which

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Solid State Technology

A Review: Design & Fabrication of Semiconductor Diode Using Phase Change Material (GST) for Nanotechnology Application

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Abstract

A PN-intersection is shaped when an n-type material is intertwined with a p-type material
making a semiconductor diode. The diode conducts uneven so it might be utilized for the current restricted
circuit, with its applications like rectifier, over-voltage limiter, for cutting and bracing circuit, as a
demodulator gadget and so on. If both sides of the intersection are made of some sort of material (for
example Silicon), the gadget/intersection is called homo, and in any case the gadget/intersection is called
hetero-intersection/diode. There are 2 strategies to create a diode/intersection, i.e., doping which is favored
for homo- intersections and testimony which is favored for hetero-intersection. The doping requires modern
machines in that we need to diffuse or embeds some other material into silicon wafers, and afterward it will
give naturally limit to the diode which goes about as an intersection. In this paper, a survey is made on
different Phase Change Material (GST) used to design diode for nano

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A Review: Antitheft Sensor Controlled Home Security System

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Abstract— **Security is one of the important systems in the various fields which are specially used for home security purpose. Applications such as detecting unauthorized entry into home, hotels, industries, labs which created need for cost effective home security system. This system consists of 89S52 microcontroller board, IR sensor module, Wireless camera to capture the image of a person, Vibration sensor if someone tries to break the door or glass of the home, Micro switch, ASK transmitter and receiver, Proximity sensor which is used to sense the unauthorised entry, LCD to display the resulting status and GSM module for the communication such sending message and missed call to the user and nearby police stations in any emergency.**

Keywords— **Microcontroller, Sensor, Wireless Camera, LCD, GSM.**

I. INTRODUCTION

Security may be a big challenge everywhere because theft is increasing day by day due to the unsafe and insecure security system in homes, commercial complexes and industries. Several conventional technologies are available to stay home properties safe from intruders, but commonest smart home security systems work on wireless Global System for Mobile communication (GSM). By this our security system provides good amount of security for the users. This technique is often easily operated and installed anywhere. The user is notified by Short Messaging System (SMS) or an easy text message, if any threat or problem detected by the safety system. There's a connection between microcontroller and GSM modem for sending the message to the owner.

The aim of the project is to switch an existing safety and security model for the house security system. This project designs an embedded system. For remote monitoring for the domestic environment nowadays home monitoring is important for safety and security purpose, which help us to understand the status of the home in our absence. The parameters inside the home will detect the unauthorized entry and illegal activities using respective sensors. e unauthorised entry and therefore the detected data are transferred to the ASK receiver with the assistance of ASK transformer with the assistance of microcontroller and GSM modem which is installed within the security system. The advantage of this automated security system is that it offers faster reaction time and accurate detection during the emergency by a SMS to the nearest police headquarters and therefore the home owner.

II. BLOCK DIAGRAM

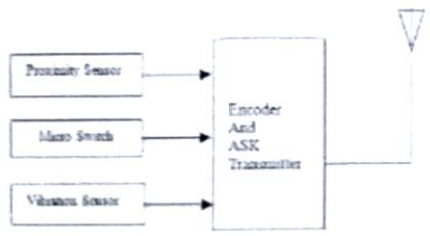

Fig 1: Block diagram of security system inside the home

An antitheft sensor controlled home security system consists of multiple sensors, encoder and ASK Tx in fig1. The IR based Proximity sensor is employed to sense unauthorized entry. A proximity sensor detects the presence of objects that are nearly placed with none point of contact. Since there's no contact between the sensors and therefore the sensed object and lack of mechanical parts, these sensors have long functional life and high reliability. Vibration sensor is employed to detect if a person tries to interrupt the door or window, and therefore the output of vibration circuit is fed to the encoder to the input and to the ASK Tx to transmit the signal. If anyone within the range in critical position one can simply press the micro switch in order that the encoder will get the signal. Encoder converts the parallel data into serial data and fed to the ASK Tx for serial transmission. ASK Tx transmits the bits in serial mode with a carrier frequency of 433MHz.

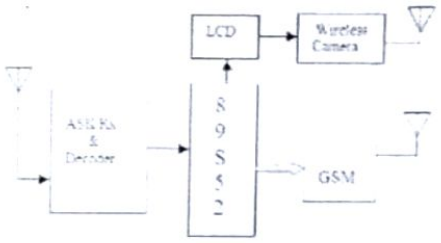

Fig 2 Block diagram of security system outside the home

ASK Rx receives the digital data transmitted from the ASK Tx and is fed to decoder. The decoder converts the serial data into parallel data and fed to the microcontroller. The 89S52 microcontroller is that the heart of the project, it controls the working consistent with the program meaning microcontroller sends appropriate pulse/signals to display unit to display the parameter problems and send the message to the GSM modem. With the assistance of GSM modem the SMS is transmitted for sending message, a GSM modem named SIMCOM 300 with RS232, power supply. The interface between GSM modem and microcontroller also can be done through with the assistance of wires.

III. LITERATURE SURVEY

A literature survey or a literature review in a project report is that section which shows the various analyses and research made in the field of interest, and it is the most important part of the report as it gives a direction in the area of the research.

Javare et al [1] have proposed door lock system using Bluetooth technology to improve security in home automation.in this Bluetooth is used to establish the connection between user and pc so as to access the door. Sensor like motion sensor and vibration sensor are used to detect the woman. The system is also facilitated with features like SMS, Email, Anti-burglar that provide easy way for the owner to get the notified when user appears at the door as well as when user try to access the door without permission. Owner can also check the log details by interacting with the PC Admin. The camera is connected to micro-controller which is used to take snaps of the users at the door and a wireless camera and monitoring control system which consist of many different activities like detecting user, verification, notification, perform action according to request, also further notifies the owner about the current status of the door.by using this technology the percentage of crime can be reduce.

Consequence of hot electron of Au and PbS shell thickness on photo-electrochemical and catalytic activity of ZnO@Au@PbS nanorods for decomposition of toxic organic chemicals and Cr(VI) reduction by UV-to-Near-Infrared photon harvesting

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Abstract:

In this research work, we have synthesised ZnO@Au@PbS nanorods (NRs) with different shell thickness by a facile chemical method. On introduction of Au nanoparticles (NPs) and PbS shells, the defect emission of ZnO NRs quench and the charge separation process enriches. Under simulated solar light irradiance the photoconductivity and charge transfer efficiency also escalate with Au NPs and PbS shell along with enhancing photocatalytic degradation of organic contaminant. The excitation wavelength dependent catalytic activity confirmed the significant enrichment in photocatalytic activity owing to the synergistic influence of Au NPs and PbS coating on ZnO NRs. The effect of aqueous solution pH and PbS shell thickness on photocatalytic reduction of Cr (VI) has been also explored. The possible charge transfer mechanism during the photocatalytic activity of ZnO@Au@PbS NRs is also proposed and analysed. The catalytic activity, stability and recyclability results revealed that ZnO@Au@PbS NRs are highly favourable and reusable for the environmental remedies.

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TiO_2@Au@$CoMn_2O_4$ core–shell nanorods for photo–electrochemical and photocatalytic activity for decomposition of toxic organic compounds and photo reduction of Cr^{6+} ion

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Abstract:

TiO_2@Au@$CoMn_2O_4$ core–shell nanorods (NRs) were prepared using a novel and facile hydrothermal process. The UV-Visible absorption and emission spectra, Transmission electron microscopy (TEM) image, X-ray photoelectron spectroscopy (XPS) spectra and X-ray powder diffraction (XRD) pattern confirmed the formation of core-shell nanocomposite. The TiO_2@Au@$CoMn_2O_4$ core-shell nanocomposites show superior photocatalytic degradation efficiency for degradation of toxic organic dyes such as rhodamine b, methylene blue and methylene orange. Taping experiments, using scavengers, were studied to explore the role of charge carriers and radicals in the photocatalytic degradation process. The catalytic activity of TiO_2@Au@$CoMn_2O_4$ core–shell nanocomposite was further reconnoitred and compared for the photocatalytic reduction of Cr^{+6} ion. The superiority in the photocatalytic activity of TiO_2@Au@$CoMn_2O_4$ core–shell nanocomposite is attributed to efficient harvesting of solar light, charge carrier separation at the interface and SPR generated hot electrons from Au nanoparticle. The photo–electrochemical photocurrent generated under illumination by solar light established effective charge carrier generation and separation. The TiO_2@Au@$CoMn_2O_4$ core-shell NRs thin film shows about 17.5 times higher photocurrent generation than the TiO_2 NRs.

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Low-molecular weight polydimethylsiloxane, a versatile performance enhancer for the solution processed indium tin oxide transparent electrode

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Keywords : indium tin oxide, post treatment, oxygen vacancy, polydimethylsiloxane, Ar plasma, Smart glass

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