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DISCUSSION ABOUT THE SENSORS AND ITS CLASSIFICATION

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ABSTRACT

The aim of this study is to nanostructured ZnO powder and thin films by chemical routes, hydrothermal method and spray pyrolysis technique. The prepared powder and thin films were characterized by using different techniques such as XRD, SEM, TEM and UV-visible spectroscopy to correlate with their gas sensing performance towards hazardous and toxic conventional gases such as H2S, NH3, LPG, CO, CO2, O2, H2, ethanol and Cl2. In this work we tried to prepare Nano crystalline materials and thin films by using chemical routes, hydrothermal method and SPT. These films and materials were analyzed and tested to various gases. The unique data and results have been published in referred journals. But to achieve monodispersed Nano crystalline materials and thin films remains a challenge for us. There are reports to prepare monodispersed nanocrystalline materials and thin films by using ultrasonic atomization technique and ultrasonic spray pyrolysis (USP) technique. Moreover, nowadays due to increased threat of international terrorism and their use of toxic chemical attack, societies need to pay more attention on protecting their citizens from attack of toxic chemicals, either by accident or terrorist act. Therefore fast detection and identification of toxic chemicals is crucial for efficient protection of citizens.

Keywords: - Chemical, Powder, XRD, SEM, Gases.

I. INTRODUCTION

HEALTH HAZARDS

Different gases cause various health hazards. Exposure to air pollution is associated with numerous effects on human health, including pulmonary, cardiac, vascular, and neurological impairments. The health effects vary greatly from person to person. On the basis of nature and kind of gases few health hazardous gases are discussed below.

(i) Ammonia (NH3)

Ammonia is utilized extensively in many chemical industries, fertilizer plants, refrigeration systems, etc. A leak in the system can result the health hazards. Ammonia is harmful and toxic in nature, the exposure of ammonia causes chronic lung disease, irritating and even burning the respiratory track, etc. Therefore all industries working on and for ammonia should have an alarm system detecting and warning for dangerous ammonia concentrations.

(ii) Carbon dioxide (CO2)

The atmospheric concentration of CO2 at present is about 356 ppm. The greenhouse contribution of CO2 is 50 %. If the present emission trend of CO2 continues, a global warming of 3.5 to 4.5 oC is likely to occur. It has been estimated that, the sea level may rise 0.5 to 1.5 m in the next 50 to 100 years. An increase in average global temperature is likely to increase the incidence of infectious diseases.

(iii) Chlorine (Cl2)

Chlorine is yellowish-green gas having pungent smell, which is explosively utilized in industrial applications such as to bleach paper pulp, to disinfect sewage and drinking water, etc. As it has wide range of applications, its toxicity can affect the health of humans in contact. Chlorine has excellent bleaching ability, but once it is discharged in aquatic systems, it interacts with other industrial effluents to produce a host of chlorinated organic such as dioxin. Dioxin persists in the environment for prolonged periods and has tendency to bioaccumulate in the food chains, which elicits toxic effects to humans, such as skin infection, psychological disorders and even liver damage.

(iv) Hydrogen (H2)

Hydrogen is an energy carrier has widespread application such as fuels. It is colorless and odourless gas. Its leakage cannot be noticed easily. This gas is potentially hazardous because of explosion possibility.

(v) Ethanol (C2H5OH)

Pure ethanol is called as an absolute alcohol. Ethanol is used for beverages, scientific and industrial purposes. Ethanol can be made by fermentation of sugars and it is the alcohol of all alcoholic beverages. The synthesis of ethanol in the form of wine by the fermentation of sugars of fruit juices was probably our first accomplishment in the field of organic synthesis. Sugars from a wide variety of sources can be used in the preparation of alcoholic beverages. Often, these sugars are from grains, so, ethanol is referred as "grain alcohol".

(vi) Liquefied petroleum gas (LPG)

Liquified natural gas (LNG) and liquified petroleum gas (LPG) are highly inflammable gases. They are explosively utilized in industrial and domestic fields as fuels. They are referred as town or cooking gases. Cooking gas consists chiefly of butane (55-vol %), a colorless and odourless gas. It is usually mixed with compounds of sulfur (methyl mercaptan and ethyl mercaptan) having foul smell, so that its leakage can be noticed easily. These gases are potentially hazardous because explosion accidents might be caused when they leak out by mistake. It has been reported that, at the concentration up to noticeable leakage, it is very much more than the lower explosive limit (LEL) of the gas in air. So, there is a great demand and emerged challenges for monitoring them for the purpose of control and safety applications in domestic and industrial fields.

II. NEED OF SENSORS

Nowadays, there is a general opinion in both scientific and engineering community that there is an urgent need for the development of cheap, reliable sensors for the control and measuring systems, for the automation of services and for the industrial and scientific apparatus. The sensors are required basically for measurement of physical quantities and for use of controlling some systems. Presently the atmospheric pollution has become a global issue. Gases from auto and industrial exhaust are polluting the environment. The reducing gases such as CO, H2, C2H5OH, oxygenic gases such as: CO2, NOX, O2, CH3OH, CH4, odourous gases such as: NH_3, H_2S, explosive gases such as: C_2H_2, C_2H_4, C_3H_6, C_3H_8, LPG and, toxic gases such: CO, H_2S, Cl_2, NO_2 etc. have to be controlled for the healthy survival of the living beings. Thus, there is an increasing concern about minimization of the emission of autointoxication and also to reduce emission of such unburnt hydrocarbons from automobile and industrial exhausts. In order to dectect, measure and control these gases, one should know the amount and types of gases present in the ambient. Thus the need to monitor and control these gases has led to the research and development of a variety of sensors using different materials and technologies.

III. CLASSIFICATION OF SENSORS

(I) On the basis of external power requirement

On the basis of external power requirement, the sensors are classified passive sensors and active sensors.

(a) Passive sensors

The sensor which requires external power to generate an output signal in response with input signal is called as a passive sensor. Passive sensor is also referred as parametric sensor, because its own properties change in response to an input signal and change in the properties can be converted into output e.g. thick and thin film sensors.

(b) Active sensors

They directly generate an output signal without any additional energy, in response to the external input, e.g. thermocouple or a pH-meter.

(II) On the basis of applications

On the basis of applications, sensors are classified as physical sensors and chemical sensors as represented in Table 1.1.

Table 1.1: Sensor classes and their detecting properties

Class	Detecting properties
(i) Physical Sensor	
(a) Optical	light intensity, wavelength, polarization, etc.
(b) Mechanical	length, acceleration, flow, force, pressure, etc.
(c) Magnetic	magnetic flux density, magnetic moment, etc.
(d) Thermal	temperature, specific heat, heat flow, etc.
(e) Electrical	charge, current, voltage, resistance, inductance, etc.
(ii) Chemical Sensors	
(a) Gas	organic and inorganic gases.
(b) Humidity	water molecule

(i) Physical sensors

Physical sensors employ physical effect such as piezoelectric, ionization, magnetostrictional, thermoelectric, photoelectric, magnetoelectric, etc. Physical sensors further classified as:

(a) Optical sensor

The sensor, which gives response to light radiation, is called as optical sensor. The conductivity of the field changes when the radiation of definite frequency or wavelength falls on it. Photoconductivity and photovoltaic effects are the phenomena used for optical sensor. e.g. CdS.

(b) Mechanical sensor

The change in displacement, velocity, pressure, acceleration and sound intensity are the input signals for mechanical sensors. These types of sensors are particularly used for measuring fluid level, velocity, pressure, acceleration etc. These are fluid level sensors, LVDT, pressure sensor, potentiometer etc.

(c) Magnetic sensor

The sensor which gives response to the magnetic field is called as magnetic

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sensor. The conductivity of the sensor changes when magnetic field strength and direction of magnetic field change. In Hall effect, mobility is used for the magnetic sensor. In mageneto-resistive effect, the resistance of the material changes when subjected to the changing magnetic field. The sensor is used to find the magnetic field strength as well as its direction. Ni based magnetic sensors are well known.

(d) Thermal sensor

The sensor which gives response to the change in temperature of the environment and the required system is called as temperature sensor e.g. thermocouple, pyrometer, thermisters, IR detectors etc.

(e) Electrical sensor

The sensor which gives response to change in charge or current or voltage or resistance or inductance is known as electrical sensor.

(ii) Chemical sensor

The sensor which gives response to chemical vapors is called as chemical sensor. Among of all, gas sensor is most important, because various industries and automobiles exhausting toxic and hazardous gases.

IV. CONCLUSION

A chemical warfare/weapon agent (CWA) is a chemical substance whose toxic properties are used to kill, injure or incapacitate. About 70 different chemicals have been used or stockpiled as chemical weapon agents during the 20th century. These agents may be in liquid, gas or solid form. Furthermore, in the case CWAs, OPCW provides 43 chemical groups or specific chemicals in three schedules. All together, the request for number of chemical agents to be detected and identified by CWA-TIC detector raises easily over 150 agents providing an extreme challenge for the detector developers. Fortunately, many suitable sensor and spectrometer technologies have been demonstrated and are also available in the market. Detectors deploy for example ion mobility spectrometers, IR spectrometers, flame photometric detectors, solid-state gas sensors and electrochemical sensors and their combinations. Basic key figures of these CWA-TIC detectors are detection, identification and quantification performance. Also response time can be considered as a key figure. Other favoured features are the capability of continuous operation, low weight, small size and ease of operation. However, any of the CWA-TIC detectors available in the market today does not meet all the requirements regarding detection and identification performance and other technical challenges. Therefore, there is still significant need for further technology development.

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