Annals of the Academy of Romanian Scientists
Series on Science and Technology of Information
ISSN 2066-8562 Volume **9**, Number **1**/**2016**

SONOCHEMICAL SYNTHESES OF METAL OXIDE NANOCOMPOSITES FOR GAS SENSING

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Abstract. *This paper proposes several sonochemical synthesis methods to obtain metal oxides nanopowders suitable for gas sensing. The synthesis process for metal oxide heterojunctions that combines n-type metal oxide semiconductors and p-type metal oxide semiconductors, such as ZnO-CuO, is presented. Examples of synthesis methods employing either chlorides only or acetates only as precursors are also inserted.*

Keywords: Sonochemistry, Gas Sensors, Metal Oxide Semiconductors

1. Introduction

Detection of flammable gases (methane, propane), volatile organic compounds (VOC) or other toxic gases (e.g. hydrogen sulfide) is of high importance for safety and process control in chemical, petrochemical and other manufacturing industries, as well as for safety of homes and buildings. The discovery of the property of the metal oxide (MOX) thin films to change their electrical conductivity as a function of the reducing and oxidizing gases from the ambient, more than fifty years ago, has triggered the realization and commercialization of the first solid state gas sensors based on these materials [1]. Even though these sensors can be used for both domestic and industrial portable applications, the power consumption needed for heating the substrate to the optimum sensing temperature and reading the detector response ranges between 660 mW and 850 mW. Such a high level of power consumption requires frequent battery replacement, which in applications such as portable personnel protection equipment for people working in hazardous environments (refineries, power plants, etc.), might lead to serious safety issues, besides an increased cost of operation. In addition, these sensors are detecting gases at relatively high concentrations. However, in safety applications, it is useful to detect lower gas concentrations. Therefore, there is a strong industrial motivation to decrease power consumption and increase both sensitivity and selectivity of sensors detecting gases such as CH_4, H_2, CO, benzene, H_2S etc.

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