Chapter 45
Impedance Spectroscopy of Tellurium Thin Films Sensitive to NO_2

D. Tsiulyanu and O. Mocreac

Abstract Impedance spectra of tellurium thin films with interdigital platinum electrodes have been measured in dry synthetic air and gaseous media with nitrogen dioxide. Analyses of Cole-Cole plots allowed to evaluate the characteristic frequency, time constant, resistance and capacity of the film in dry air and a mixture containing NO_2. It is shown that the impedance spectra, being strongly influenced by the gaseous environment, do not change their general shape. The effect of NO_2 is mainly a variation of the resistance of the while the capacitance does not vary significantly. The sensitivity of the impedance or its imaginary part depends on the frequency and is on the order of ~ 50%/ppm. It is suggested that the effect of NO_2 results from "strong" chemisorptions of NO_2 molecules on the surface and the intragrain regions of the Te film.

Keywords Gas sensors · Impedance spectroscopy · Tellurium · NO_2

Introduction

Tellurium based films may be used for the detection of harmful gases at room temperature. Tis possibility was first pointed out for NO_2 [1]; thereafter, similar sensors have been reported for the detection of CO [2] and NH_3 [3]. Although the cross sensitivity to these gases is essential different, it is important to detect namely the target gas. One possibility to obtain a selective detection of these gases has been proposed by Sbeveglieri [4] and consists in a fast sweeping of the sensitivity of a single sensor at different frequencies. That is, by monitoring the a.c. conductance at a specific frequency, the sensitivity to different gas components can be enhanced [5]. Moreover, a.c. measurements allow to obtain impedance or admittance spectra of a sensor, to calculate an equivalent circuit and to distinguish between contributions from the surface, bulk or contacts to the film conductivity [6].

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