International Journal of Semiconductor Science & Technology.
ISSN 0975-6493 Volume 3, Number 1 (2012), pp. 1-9

http://www.ripublication.com

An Investigation of the Electronic Properties of Cadmium Telluride using Space Charged Limited Current

Ali M. Mousa[1] and J.P. Ponpon[2]

[1]Department of Applied Sciences, University of Technology, P.O. Box 3051, Baghdad, Iraq
[2]InESS, umr 7163, Laboratoire commun Universite´ Louis Pasteur et CNRS, B.P. 20, F67037 Strasbourg, France

Abstract

The present work reports the D.C. conductivity measurements at high electric fields in a CdTe bulk material. The Current-voltage (I-V) characteristics were measured at fixed temperatures. Two samples, one at high polarization and the other was quasi free were used. At low electric fields, ohmic behaviour was noticed, while, at high electric fields, a non-ohmic behavior was observed. An analysis of the experimental data indicates that in these materials, a space charge limited conduction (SCLC) was observed. The transition voltage (VTR) from ohmic to SCLC is found to be quite independent of the ambient temperature in the low temperature range. At high temperatures, the transition voltage increased with temperature for the sample with polarization and decreased with the second. Deep Traps estimated from the ln I vs $10^3/T$ plots were found to be within 0.73–0.76 eV in the sample where polarization manifested and 0.5eV in the other. Besides, a range of trap centers with different energies were revealed. Using the relevant SCLC theory, the total trap concentration Nt and the ratio of the free charge to trapped charge θ were found.

Keywords: SCLC, deep levels, CdTe, recombination centers, polarization

Introduction

Room temperature semiconductor cadmium telluride detectors have become devices of great interest in the field of X and γ-ray imaging, and shown great promise as highly efficient room-temperature operation detectors [1, 2]. Performance of the semi-insulating CdTe based detectors has been impeded by carrier trapping at