DEVELOPMENT OF AN AUTOMATED SETUP FOR MEASURING DEFECT LEVELS IN SEMICONDUCTORS

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In this article, a computer aided setup for measuring defect energy levels is introduced. The idea is bassed on the Deep Level Transient Spectroscopy (DLTS) technique developed by D.Lang in 1974. A Sula Deep Level Spectrometer is used to monitor the transient capacitance. Two different kinds of interface systems were used for data acquisition and automatic control, namely, the IEEE-488 and PCIP digital multimeter. A 386 IBM-compatible computer was used in control the whole experiment. A computer program written in PASCAL was implemented to drive the process. This setup was tested on several samples and the results obtained was compared with previously published data. It was proved to be more accurate, much faster and very reliable.

Introduction

The analysis of semiconductor materials is of crucial importance in the development technology. One of the current research tools is called Deep Level Transient Spectroscopy (DLTS). This technique uses a transient junction capacitance measurement to detect the concentration and energy levels of deep impuritiy levels. The technique has been described extensively by Lang and co-authors in the literature[1]. The experimental technique is to monitor the capacitance of a junction device after the space charge region has been filled with either majority or minority carrier charge. The trapped charges modifies the capacitance of the junction. A fast capacitance bridge is used to monitor the charge in the junction as the trapped charge in emitted to either band.

The DLTS system was interfaced with an IBM compatible computer for data acquisition and automatic control. The interfacing was done using two different types of plug-in boards; an IEEE-488 board and a PC Instrument Product (PCIP) digital multimeter board.

Experimental Setup

A block diagram of the experimental setup is shown in Fig.(1). The sample under test is placed in a double-wall cryostat to maintain thermal isolation. The temperature is