Influence of illumination intensity and temperature on the electrical characteristics of an Al/p-GaAs/In structure prepared by thermal evaporation

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Abstract

The temperature and illumination intensity dependence of current-voltage (I-V) and capacitance-voltage (C-V) characteristics of the Al/p-GaAs barrier diode were investigated. The ideality factor (n) and zero-bias barrier height (Phi(b0)) were found to be strongly temperature dependent and while Phi(b0) is decreased, n is increased with decreasing temperature and illumination. The reverse biased I-V measurements under various illuminations exhibited a high photosensitivity. The values of R-s obtained from Cheung's method are decreased with increasing illumination intensity. The interface capacitance of the diode is increased with the increase of illumination intensities. The profiles of interface state density (N-ss) distribution as a function of (E-ss-E) were extracted from the forward I-V measurements by taking into account the bias dependence of the effective barrier heights (phi(e)) for device under dark, illumination and temperature conditions. Furthermore, modified Richardson plot has a good linearity over the investigated temperature range. As a result, the electrical characteristics of diode are affected not only in illumination but also in temperature. It is evaluated that the prepared diode can be used as photocapacitance sensor in modern electronic and optoelectronic devices. (C) 2012 Elsevier B.V. All rights reserved.

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