Opt Quant Electron (2013) 45:873–884
DOI 10.1007/s11082-013-9689-x

Normal distribution profile for doping concentration in multilayer tunnel junction

Shahram Mohammadnejad · Nima Jouyandeh Abkenar · Ali Bahrami

Received: 7 November 2012 / Accepted: 17 April 2013 / Published online: 3 May 2013

Abstract In this paper, the effect of doping concentration and layer thickness on the performance of tunnel junctions (TJs) is studied. We investigate the behavior of single, double and triple layer structures of TJs. Triple layer structure shows better performance in comparison with the other structures and can reach the higher tunneling current besides lower voltage drop. Also, the behavior of the triple layer TJ with different doping concentration profiles is studied. We propose a new normal distribution profile for doping concentration in multilayer TJs which shows better performance in comparison with the linear and graded doping concentration profiles. The higher α parameters in normal distribution enhance the device performance with increasing the smoothness of doping variations in the center and edge of the TJ. Finally, we examine different thicknesses of triple layer TJ in order to achieve the optimum structure.

Keywords Tunnel junction · Doping concentration · Normal distribution · Layer thickness · Solar cell

1 Introduction

Tandem solar cells that are the most promising photovoltaic systems can absorb the different ranges of the solar spectrum. There are many considerations in design of a tandem solar cell such as the selection of materials with appropriate bandgaps, avoiding the lattice mismatch in whole structure, providing the current matching between subcells and etc (Bahrami et al. 2013; Singh and Sarkar 2012). Therefore, the design of a tandem solar cell is a very complicated process. Also, another important challenge in tandem cell fabrication is how to connect the subcells to each other. If the subcells directly connect to each other, an unwanted parasitic junction forms between two unlike regions of subcells. The best solution which is

S. Mohammadnejad · N. Jouyandeh Abkenar (✉) · A. Bahrami
Electrical and Electronics Engineering Department, Nanoptronics Research Center,
Iran University of Science and Technology, Tehran, Iran
e-mail: jouyandeh@iust.ac.ir