Physico-chemical nanomaterials science.

Origin of dislocation luminescence centers and their reorganization in p-type silicon crystal

M.O. Kushlyk, B.V. Pavlyk, D.P. Slobodzyan

Ivan Franko National University of Lviv, Department of Electronics,
79017, st. Tarnavskoho 107, Lviv, Ukraine,
E-mail: kushlykmarik@gmail.com

In recent years, the problem of the effective light-emitting structures (LES) availability came up, as well as, the possibility of introducing them into a single process of making existing receivers and radiation transmission environments. Today there are silicon sources of radiation with a wavelength in the 1.1 - 1.6 micron, but their effectiveness remains relatively low ($\eta \sim 1\%$). To increase the effectiveness of LES, it is necessary to establish the nature of recombination centers and their reorganization as a result of processing samples.

The aim of study was to investigate the role of structural defects, adsorbed atoms and molecules in the process of formation and restructuring of defect subsystem of silicon dislocation surface layer and establish the nature of surface states (SS).

The object of the research was a single p-Si (Cz, 24 Ω·cm) crystal with dislocations concentration $N_d = 5 \cdot 10^7$ cm^{-2} and additionally oxidized at high temperatures (T=1300 K). To investigate electro physical characteristics, the diode structure such as Bi-Si (Schottky diod) was produced.

The surface layer of the silicon was investigated using HU7-1 capacitance-modulation spectrometer and analyzing the current-voltage characteristics (CVCH) of the diode structures and deep levels (DL) spectra. Analysis and comparison of these experimental results with the electroluminescence research results allow us to make conclusions about the restructuring of defect subsystem in subsurface layer of silicon [1].

The study of DL showed the presence of a wide range of defects in the surface layer of the strained silicon. Comparison of ionization energies of DL calculated by the method of capacitive-modulation spectroscopy, with a maximum SS density confirms the dislocationally stimulated transition of defects into the surface and their participation in the formation of more complex surface spectrum.

1. B.V. Pavlyk, M.O. Kushlyk, D.P. Slobodzyan . About the nature of electroluminescence centers in plastically deformed crystals of p-type silicon // J. Nano- Electron. Phys.- 2015.- 7(3).- P. 03043-1 - 03043-5.