ZAHRAA JAMEEL ABDULKAREEM. SOME PROPERTIES OF TiO_2 NANOPARTICLES ON POROUS SILICON FOR OPTOELECTRONICS APPLICATION. UNIVERSITY OF TECHNOLOGY / Department of Laser and Optoelectronics Engineering. M.Sc. Supervisor : **Dr. KADHIM A. HUBEATIR** and **Dr. UDAY M. NAYEF.2015.110 p.**

Abstract

In this thesis, the research is divided into three sections. The first section includes the preparation of TiO_2 NPs by pulsed laser ablation in liquid (PLAL) technique. The Nd:YAG laser with different wavelengths (532 and 1064 nm) and energies (200, 400 and 600 mJ/pulse) was used to irradiate titanium target at 450 pules. The second section includes the formation of Porous Silicon (PS) with Photoelectrochemical etching (PECE) method at different etching current densities (10, 30 and 50 mA/cm^2) and 20% Hydrofluoric (HF) acid concentration for 10 minutes. In the last section, the optimum results of TiO_2 NPs were used on the best result of PS.

The results of TiO_2 NPs refer to its n-type semiconductor with crystallites size decreases from 72.07 to 57.76 nm accompanied with decreasing in TiO_2 NPs concentration and increasing band gap energy (3.95-4.02 eV) when laser wavelength reduced. Also, the results of PS show the nanostructure (mesoporous silicon) formed, with increasing pore diameter from 14.18 to 22.12 nm with increasing etching current density.

The morphological properties of TiO_2 NPs deposited on PS presented a good adhesion between these nanostructures leading to improve the structural stability of the PS substrate. The reflectivity gives a clear observation about enhancement of PS antireflection properties after coated with TiO_2 NPs. The electrical resistivity of the PS layer increased with the pore diameter and became higher after deposition of TiO_2 NPs. The capacitance-voltage results show that built-in potential increased with TiO_2 NPs concentration. So the detector measurements of TiO_2 NPs/PS exhibited a higher responsivity (0.053 A/W) and quantum efficiency (20.25%) with higher TiO_2 NPs concentration.

Keywords: TiO_2 nanoparticles, Porous silicon, Photodetector.