

Optical properties of treated and untreated monocrystalline p-Si<111>, p-Si<100>, n-Si<111> and n-Si<100> wafers in the visible region at room temperature

M.R Hashim*, Kifah Q. Salih

Solid State and Applied Physics Group, School of Physics, Universiti Sains Malaysia, Penang, 11800, MALAYSIA.

Silicon only based materials have dominated the electronic applications for the past few decades and now the materials have almost reached its saturation point. However there is a new great opening for silicon only based material to re-dominate consumer product market place and that is in the area of photonics. The motivation for the re-domination is driven by all silicon opto-electronics and therefore any development of silicon optical properties would hold the promise of having both electronics and optics on the same chip. Among important key ingredients for silicon technological success in photonic applications is the ability to change their refractive index and surface texture. The refractive index modification leads to the change of extraction efficiency through the change of surface roughness and material quality.

In this work, we use temperature treatment to modify optical properties and surface texture of monocrystalline p-Si<111>, p-Si<100>, n-Si<111> and n-Si<100> wafers. Optical properties of our samples were observed using both ellipsometry and photoluminescence (PL) systems and surface roughness is observed using atomic force microscopy (AFM) technique. The PL system used a green laser operating at 543.5 nm. The PL spectra were taken at room temperature in the visible region. The results showed that the treated samples have increased PL intensity and uniformity in the visible region compared to those of untreated samples. In addition the treated p-type Si samples showed better PL intensity enhancement compared to those of treated n-type samples. The explanation for this behavior will be discussed using AFM images and ellipsometry measurements.

* Corresponding author. Tel. 604-6533677. FAX 604-6579150.
Email address: roslan@usm.my (M.R Hashim).