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INVESTIGATION OF SIZE AND BAND GAP DISTRIBUTIONS OF SI NANOPARTICLES FROM MORPHOLOGY AND OPTICAL PROPERTIES OF POROUS SILICON LAYERS FORMED ON A TEXTURED N^+ P SILICON SOLAR CELL

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ABSTRACT

Fabrication of PS layers (PSLs) was performed by electrochemical etching process on the front side of textured n^+p Si junctions. The structural andoptical properties of the treated textured cells was investigated and compared with the untreated textured cell under the variation ofetching current densities. Surface morphology and the crystallites size of PS were characterized by using scanning electron microscope (SEM) and X-ray diffraction (XRD), respectively. The porosity of the PSLs was determined gravimetrically and it was dependent on etching current density. The reflection measurements showed an excellent light trapping at wavelengths ranging from 200 to 1000 nm at 30 mA/cm^2 etching current density. The optical absorption coefficient was calculated from the reflection spectra and the optical band gap was determined. The value of the energy gap (E_g) was also determined by applying the Kubelka–Munk (K–M or F(R)) method. From the photoluminescence (PL) measurements, the PL peak intensity increases upon increasing the porosity and also shows slight blue shifts at 629 nm and 640 nm as the porosity increases. The band gapsof PSLs obtained from the photoluminescence measurements and from the reflection data were compared. It is found that the band gap increases in a range between1.84 eV and 2.23 eV, which is higher than the band gap of silicon (1.12 eV). It is obtained that the fabrication of the solar cells based on the PS anti-reflection coating (ARC) layers exhibited its high performance to enhance and increase the photo-conversion process and increasing light absorption at 30 mA/cm^{2}etching current density.

KEYWORDS: *Porous Silicon, XRD, SEM, ARC, Solar Cell, PL, Band Gap*

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