Growth of silicon nanowires for improving optical and electrical properties of silicon solar cell

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This work explains the growth of silicon nanowires (SiNWs) on the silicon wafer using the etching method which is directly used for the fabrication of crystalline Silicon solar cell without antireflection layer. SiNWs were optimized in terms of sizes, lengths and densities by changing the etching conditions. Well-defined and aligned wires like structures were achieved when the etching time was 20 min. The grown SiNWs displayed the minimum reflectance ~2.24% at 840 nm with the average reflectance of ~2.38% in the wavelength range from 400-1000 nm. The SiNWs length and average reflectance were used as input parameters to instigate the power conversion and quantum efficiencies of solar cells through PC1D simulation. The high conversion efficiency of ~16.17% observed when the average length of SiNWs and reflectance were ~2.528 mm and ~2.25%, respectively. Thus, this method (controlled etching) is an easy, facile method for preparation of nanostructured like wires on Si wafer with low reflectance in whole visible region, which has greater prospects in developing c-Si solar cells without AR layer.