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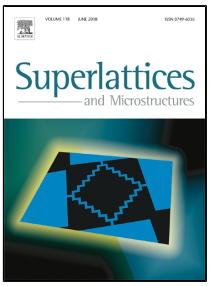

Single-crystalline Si nanowires fabrication by one-step metal assisted chemical etching: The effect of etching time and resistivity of Si wafer

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Single-crystalline Si nanowires fabrication by one-step metal assisted chemical etching: The effect of etching time and resistivity of Si wafer

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Abstract: The one-step metal assisted chemical etching (1-MACE) of p-Si wafers with different resistivities and etching time in HF/$AgNO_3$/H_2O_2 aqueous solution, resulted in large-area vertical Si nanowires (SiNWs). The field emission scanning electron microscopy (FESEM), and transmission electron microscopy (TEM) revealed that the diameters and lengths of nanowires are decreased with increasing the doping level of Si wafer, while their roughness and porosity are increased. The selected area electron diffraction (SAED) patterns showed that SiNWs retain their single-crystal structure of starting wafers. The reflectance spectra indicated that the etched samples have a very low reflectance (~0.1% and less) in the visible range acting as an anti-reflecting and high absorption layer in solar cells. Furthermore, broadband PL emissions are observed only in samples etched for 60 and 80 minutes, that are well consistent with the TEM images and Raman shift spectra analysis considering the formation of Si nanocrystals (SiNCs) (~2.3-3.5nm) decorated on the sidewalls of the nanowires.

Key words: 1-MACE; SiNWs; Si wafer resistivity; Etching duration; TEM; SAED