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Silicon nanowire arrays with passivated axial p-i-n junctions for photovoltaic applications PENG ZHANG, PEI LIU, ALEXANDER ZASLAVSKY, DOMENICO PACIFICI, Brown University, JONG-YOON HA, SERGIY KRYLYUK, University of Maryland and NIST, ALBERT DAVYDOV, NIST — Metal catalyst-assisted vapor-liquid-solid mechanism can be used to grow large areas of nanowires (NWs) with compositional and doping control in either axial or core-shell geometries. Here, we report on vertical arrays of Si axial *p*-*i*-*n* oxide-passivated NWs that were 12 microns long with a 4 micron intrinsic section. The NW arrays were planarized using SU-8 photoresist, followed by reactive ion etching to expose the NW tips. Top *n*-contact was realized by sputter deposition of a 200 nm IZO layer. The *p*-contact was made by backside metallization of the *p*-Si substrate. Under AM 1.5 illumination, unpassivated NW arrays exhibited an open-circuit voltage, V_{OC} of 170 mV, a short-circuit current density J_{SC} >3.7 mA/cm^2 (with uncertainty due to the unknown fraction of properly contacted NWs), and a fill factor of 28.9%. After the passivation, V_{OC}, J_{SC} and FF increased to 250 mV, >9.2 mA/cm^2 and 35.7%, respectively. The measured normal reflectance was around 6% over the 400–1000 nm spectral range, whereas the diffuse reflectance was around 20% over the same range, indicating strong light scattering and absorption by the NWs. The photovoltaic performance of passivated single NWs and NW arrays were compared using a 532 nm laser with a power density of about 10 W/cm^2. Higher values of V_{OC} and FF obtained for the latter are explained by light trapping in the NW arrays.

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