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 $J_{SC} >3.7 \text{ mA/cm}^2$ (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, $>9.2 \text{ mA/cm}^2$ 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.