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Nanowire array PV cells for enhanced photonic and electronic performance

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Many nanotechnology based enhancements for solar cells have been proposed. On the one hand, inorganic nanoparticles, nanorods, and nanowires (NWs) have been incorporated into organic solar cells to extend the available interface for charge separation and improve the overall mobility of the material. On the other hand, for conventional inorganic solar cells, it has also been theoretically shown that NW-like structures could potentially lead to a better collection efficiency of photogenerated carriers together with greater optical absorption from low purity material.Particular attention has been placed on the coaxial core/shell NW structure, where charge separation of photo-generated carriers occurs in the radial direction i.e orthogonally to the carrier transportation path. This idea can be implemented either with a core–shell NW p–n junction or with a core–shell structure formed by two materials with type-II band alignment, which separate charge at the interface without the need for doping From a practical point of view, however, clear evidence about NWs solar cells outperforming existing solutions based on planar thin films is still lacking.

Silicon-based solar cells currently dominate the photovoltaic (PV) market. Several attempts have been made to fabricate solar cells based on coaxial silicon nanowires (SiNWs). Here we report an approach of fabricating interpenetrated electrodes, i.e., a multi-shell coaxial NW structure where a metallic inner core and a metallic outer shell act as proximity electrodes for the radial junction sandwiched in between. A novel core-multishell NW structure to realize solar cells with interpenetrated electrodes is presented. It is based on coating vertically aligned multiwall carbon nanotubes (MWNTs) with amorphous silicon (a-Si:H) shells and indium tin oxide (ITO).