

GaAs/GaP Heterostructure Nanowire Photovoltaics

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Semiconductor nanowire arrays for photovoltaic devices have been demonstrated in numerous material systems due to several unique advantages over traditional planar geometries. Benefits include reduced material costs, short carrier collection paths while maintaining long absorption lengths, simplified incorporation of multi-bandgap devices and heterostructures due to strain accommodation, and light trapping intrinsic to nanowire array geometries. III-V nanowire systems have yet to achieve efficient radial extraction of carriers or to realize beneficial heterostructure designs that may breach the Shockley-Queisser limit for a single junction cell. Recent research into GaAs/GaAsP and GaAs/GaP nanowires has revealed promising axial and radial geometries for multiple quantum well and hot carrier solar cells, respectively. Preliminary structures have been examined by scanning electron microscopy to determine nanowire dimensions and array density, transmission electron microscopy and energy dispersive spectroscopy to characterize individual heterostructure nanowires, and photoluminescence measurements to determine the extent of carrier confinement in both axial and radial heterostructures.

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