

## **Recent progress in Si hetero-junction solar cell: A comprehensive review**

### **Abstract**

Currently single junction Si solar photovoltaic limitation and scope of Si hetero-junction cell has driven research towards advanced solar cell. Successful absorption of high energy band and its apposite photonic conversion by high band gap Si nanostructure favors to minimize thermalization and carrier recombination problem thus progress efficiency significantly. Inclusion of indium molar fraction in GaN and its variance for wide band gap III-Ns (InGaN/GaN) on Si cell considerably improves opto-electric properties. Theoretically series model is revealed by novel approach to realize current density matching in III-N/Si hetero-junction tandem cell that has potential to moderate the tunneling difficulty. Hence, cutting edge surface processing techniques to improve the photonic properties of Si and InGaN nanostructures on Si cell have been reviewed comprehensively. Simulated and practical efficiency of different nanostructures have been investigated to analyze the practical efficiency limiting issues. Finally, key materials absorption edge, drift velocity, efficiency progress and present market share related utilization factor have been addressed.