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Inventors

Andre Filipe Rodrigues Augusto

Stuart Bowden

Apoorva Srinivasa

Contact

Shen Yan
shen.yan@skysonginnovations.
com

Photovoltaic Devices with Very High Breakdown Voltages

-Background When a solar cell is operated in reverse bias in dark conditions, a very small drift current, called leakage current, flows due to minority carriers. Breakdown voltage for solar cell refers to the minimum applied reverse dark voltage that results in an exponential increase in leakage current. When solar cells are connected in series in a module, shading in any part of the module can cause cells to go into reverse bias, and reaching breakdown can cause overheating or even a fire. Although modules have bypass diodes designed to prevent the cells from going into breakdown, these diodes often contend with high failure rates.

Invention Description Researchers at Arizona State University have developed a high-efficiency silicon photovoltaic cell featuring very high breakdown voltages. By combining a device architecture with very low surface recombination and silicon wafers with high bulk resistivity (above 10 Ω -cm), breakdown voltages close to 1000 V are achieved. These photovoltaic cells with high breakdown voltages improve the reliability of photovoltaic devices while reducing their design complexity and cost. Potential Applications • Silicon solar cells Benefits and Advantages • Achieves efficiencies over 20% for silicon solar cells manufactured on wafers with bulk resistivities over 1000 Ω -cm • Breakdown voltages close to 1000V • Contributes to device reliability by preventing breakdown in the event of bypass diode failure Related Publication: [Influence of the Bulk Resistivity on Silicon Heterojunction Solar Cells and Module Reliability](#) Faculty Profile of Professor [Stuart Bowden](#)

