Area 1:.Crystalline and Thin Film Silicon PV

MICRO-GRID ELECTRODE FOR SI MICROWIRE SOLAR CELLS WITH A FILL FACTOR OF OVER 80%

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In this study, we demonstrate a highly efficient radial-junction Si microwire solar cells using a novel microgrid top electrode. The microgrid electrode ensures proper function of the shallow (sheet resistance of ≈100 Ω sq^{-1}) junction emitter by minimizing optical and electrical losses. This improves the overall power conversion efficiency of the Si microwire solar cell, causing effective collection of the photocarriers from the shallow junction emitter through the top electrode without severe Auger/surface recombination. With an optimized microgrid structure, the microwire solar cells with an area of 1 cm^2 exhibit a power conversion efficiency of up to 16.5%, with an open-circuit voltage of 565.2 mV and a short-circuit current density of 35.9 $mA \cdot cm^{-2}$; this conversion efficiency is 72% higher than that of solar cells with an edge electrode (9.6%). Moreover, an ≈ 1μm thick Ni electrode that is formed by electroplating reproducibly yields a fill factor of over 80% (max 81.2%) by reducing the metal and contact resistances significantly. Therefore, we expect the use of a novel microgrid electrode to construct an ideal metal/emitter interface to present a unique opportunity for the development of highly efficient microwire solar cells.