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A Novel Solid Phase Epitaxy Emitter for Silicon Solar Cells

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In this study, we suggest the new emitter formation applied solid phase epitaxy (SPE) growth process using rapid thermal process (RTP). Preferentially, we describe the SPE growth of intrinsic a-Si thin film through RTP heat treatment by radio-frequency plasma-enhanced chemical vapor deposition (RF-PECVD). Phase transition of intrinsic a-Si thin films were taken place under 600°C for 5 min annealing condition measured by spectroscopic ellipsometer (SE) applied to effective medium approximation (EMA). We confirmed the SPE growth using high resolution transmission electron microscope (HR-TEM) analysis. Similarly, phase transition of P doped a-Si thin films were arisen 700°C for 1 min, however, crystallinity is lower than intrinsic a-Si thin films. It is referable to the interference of the dopant. Based on this, we fabricated 16.7% solar cell to apply emitter layer formed SPE growth of P doped a-Si thin films using RTP. We considered that is a relative short process time compare to make the phosphorus emitter such as diffusion using furnace. Also, it is causing process simplification that can be omitted phosphorus silicate glass (PSG) removal and edge isolation process.

Keywords: Solid Phase Epitaxy (SPE); radio-frequency plasma-enhanced chemical vapor deposition (RF-PECVD); Rapid Thermal Processing (RTP); Crystallization; Amorphous Silicon (a-Si)

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Influence of Surface Functional Group of Carbon Nanotubes for Applications in Electrochemical Capacitors

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Electrochemical capacitors have been the most strong energy storage devices due to high power density and long cycle stability. Pristine carbon nanotubes are promising electrode materials for excellent electrical conductivity and high specific surface area in electrochemical capacitor. However, the practical application of pristine carbon nanotubes was limited by the aggregation into bundles due to van der Waals force. In this research, we explained how multi-walled carbon nanotubes (MWCNT) functionalized by carboxyl, sulfonic, and amine groups (CNT-COOH, CNT-SO₃H, CNT-NH₂) to improve the performances of MWCNT. Functionalized CNTs showed two- to four-fold increase in capacitance over that of pristine CNTs, while maintaining reasonable cyclic stability. But, the CNT-COOH showed the lowest rate capability of 57% compared to 84%, 86% of CNT-SO₃H and CNT-NH₂. As demonstrated by the spectroscopic analysis, This reseach showed how surface functional group of carbon nanotubes change capacitor performances.

Keywords: Carbon nanotube, functionalization, capacitor