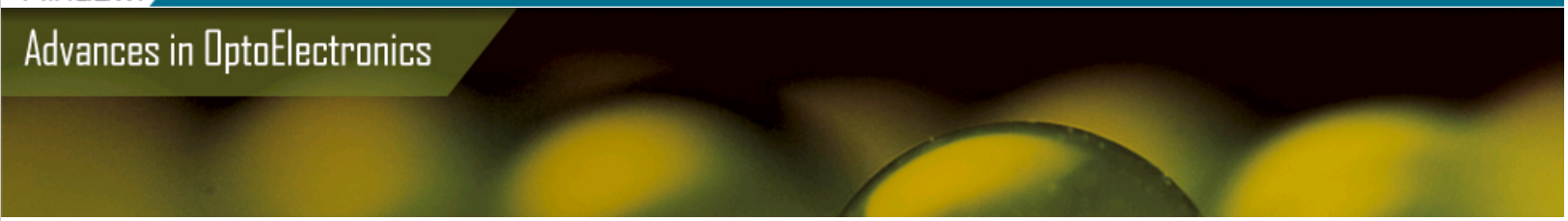

Advances in OptoElectronics
Volume 2008 (2008), Article ID 485467, 10 pages
doi:10.1155/2008/485467

Research Article

PECVD-ONO: A New Deposited Firing Stable Rear Surface Passivation Layer System for Crystalline Silicon Solar Cells

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Received 17 January 2008; Accepted 6 March 2008

Recommended by Armin Aberle

Abstract

A novel plasma-enhanced chemical vapour deposited (PECVD) stack layer system consisting of a-SiOx:H, a-SiNx:H, and a-SiOx:H is presented for silicon solar cell rear side passivation. Surface recombination velocities below 60 cm/s (after firing) and below 30 cm/s (after forming gas anneal) were achieved. Solar cell precursors without front and rear metallisation showed implied open-circuit voltages Voc values extracted from quasi-steady-state photoconductance (QSSPC) measurements above 680 mV. Fully finished solar cells with up to 20.0% energy conversion efficiency are presented. A fit of the cell's internal quantum efficiency using software tool PC1D and a comparison to a full-area aluminium-back surface field (Al-BSF) and thermal SiO2 is shown. PECVD-ONO was found to be clearly superior to Al-BSF. A separation of recombination at the metallised and the passivated area at the solar cell's rear is presented using the equations of Fischer and Kray. Nuclear reaction analysis (NRA) has been used to evaluate the hydrogen depth profile of the passivation layer system at different stages.