Light soaking effect on defect states distribution of hydrogenated amorphous silicon investigated by means of constant photocurrent technique

Revue des Energies Renouvelables, Vol. 13, No. 1, 2010, pp.63-70.

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Abstract

In the present paper we have investigated, by using the constant photocurrent method in dc-mode (dc-CPM), the effect of the light soaking (LS) on the deep defect density (Nd) and the slope of the Urbach tail (E0) of a slightly phosphorus-doped hydrogenated amorphous silicon (a-Si:H) film prepared by Plasma-Enhanced Chemical Vapour Deposition (PECVD). By applying the derivative method, we have converted the measured data into a density of states (DOS) distribution in the lower part of the energy gap. The evolution of the sub-band-gap absorption coefficient s (h ?) and the CPMdetermined density of gap-states distribution within the gap versus the illumination time leads to: (i) an increase in the deep defect absorption without any significant changes in the Urbach tail (exponential part), (ii) a presence of more charged than neutral defects as predicted by the defect pool model, and (iii) a saturation point of the degradation of both optical absorption coefficient and density of deep states of slightly P-doped sample measured by dc-CPM. The constant photocurrent technique in dc-mode as a spectroscopy method for the defect distribution determination is, therefore, most reliable to study the light soaking effect on the stability of hydrogenated amorphous silicon layers used in solar cells manufacturing.

Keywords Constant photocurrent method - Optical absorption spectrum - Light soaking - Hydrogenated amorphous silicon - Defect states.

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