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Kinetics of Light-induced Metastable Defect Creation and Annealing in a-Si:H

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Abstract: Constant Photocurrent Method (CPM) and steady state photoconductivity measurements are used to investigate the creation of light-induced metastable defects in a-Si:H at room temperature and their annealing. Light-induced metastable defect concentration N_d varies with exposure time $t_e$as t_e^r with r=0.34\ pm 0.02, as expected from the recombination induced weak bond breaking model [1]. The validity of a stretched exponential model is also studied [2]. From the annealing experiments, the distribution of thermal annealing activation energies is calculated following the method proposed by Hata and Wagner [3]. Defects created at room temperature show a narrow distribution of annealing activation energies peaking at 0.97eV. The relation between photoconductivity and N_d is strongly nonlinear. Defects created at earlier times of illumination degrade photoconductivity more strongly, and these defects anneal out more easily than those created at later times of illumination.

Key Words: a-Si:H, Staebler-Wronski effect, Light induced metastable defect, CPM, Photoconductivity, Distribution of annealing activation energies.

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