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Photoconductivity Studies of Crystalline Si:H p-i-n

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Abstract: Optically modulated photoconductivity (PC) properties of hydrogenated crystalline silicon (c-Si:H) with p-i-n junctions were investigated by frequency-resolved spectroscopy in the temperature range 20-290 K. The PC lifetime measurements of c-Si:H p-i-n show a second lifetime distribution which only dominates at low temperature under low illumination levels of excitation. Unlike the room temperature single lifetime distribution seen in c-Si:H p-i-n, the maximum of this second lifetime distribution shifts to longer times when the excitation intensity decreases, which reconciles with non-geminate pair recombination and thus the distant-pair model. In addition to lifetime measurements, the direct current-voltage (I-V) characteristics, the excitation light intensity- and electric field-dependence of the PC were also measured under various conditions. The results are discussed in terms of PC models proposed.

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