Title

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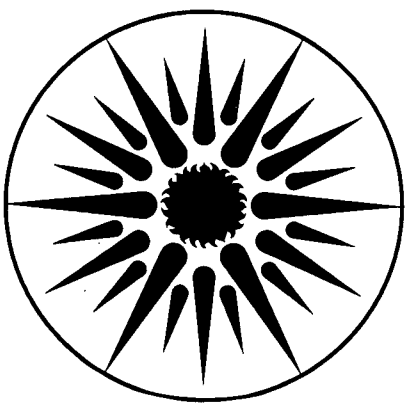

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THE EFFECT OF COMPENSATION ON PHOTO-INDUCED METASTABLE STATES IN a-Si:H

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Little attention has been given to the role of compensation on the Staebler-Wronski effect. Compensation enables the isolation of effects due to Fermi level movement. Furthermore, it was shown that in a-Si:H compensation removes Si dangling bond defects.[1]

We have investigated the effect of illumination on gap-state absorption in films of a wide range of compensation. We show that the enhancement in the absorption of Si dangling bond defects depends on the degree of compensation with the fully compensated samples showing the smallest observed enhancement. This general behavior is also observed in dark and photoconductivity measurements.

A photoinduced absorption study of these samples was also performed. We find no change in the decay rate of the photoexcited carriers between the illuminated and annealed states. Since photoinduced absorption probes the shape of the bandtails,[2] we conclude that photoinduced states in compensated samples do not significantly alter the shape of the band tails.

By combining these results with our earlier ones on undoped and singly doped material,[3] we conclude that photoinduced metastable states are due to the creation of defects and not due to shifts in the Fermi level without increasing the number of gap states. Another conclusion is that full compensation minimizes the Stabler-Wronski fatigue.

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(1) W.B. Jackson and N.M. Amer, Phys. Rev. B 25, 5559 (1982).
(2) D.R. Wake and N.M. Amer, Phys. Rev. B 27, 2598 (1983).
(3) A. Skumanich, N.M. Amer, and W.B. Jackson, Bull. Am. Phys. Soc. 27, 147 (1982); to be published.

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