Effect of Bias Illumination on Photoinduced Absorption Decay in *a*-Si:H

Zeldov and Weiser[1] proposed a model to explain the influence of optical biasing on the decay of photoinduced absorption (PA) in *a*-Si:H at high temperatures observed by Pfost, Vardeny, and Tauc.[2] This model differs from the model originally used[2] for interpreting the experimental data at temperatures higher than 80 K by neglecting carrier trapping at neutral dangling-bond sites in the material. As a result, the quasi-Fermi level set by the bias illumination will reside in the conduction-band tail ("bias-saturated band tail"). This will cause the decay of PA to become exponential (nondispersive) at long times when the carriers generated by the excitation pulse thermalize to the quasi-Fermi level.[1] In the other model,[2] the saturation by bias illumination may not occur because a substantial fraction of bias carriers are captured in the dangling-bond states; in this case the exponential decay will not be observed. This Comment reports on an experiment aimed at deciding which assumption is appropriate for interpreting the data of Ref. 2.

In an attempt to observe the onset of an exponential decay of PA, we have extended our time range as suggested in Ref. 1 (up to 0.1 s). The measurements were done at 250 K under the same conditions as in Ref. 2 except that the biasing intensity of 0.25 W/cm^2 was significantly higher than the intensities used in the previous work.[2] The exponential decay of the photoinduced change in transmission ΔT was not observed. The sharp cutoff in $\log(-\Delta T/T)$ vs $\log t$ seen in Fig. 1 is due to the base-line offset which results from the fact that the signal has not had sufficient time to decay to zero before the next excitation occurs. To remove the base-line problem, we studied the decay of $d\Delta T/dt$.[3] In the plot of $\log(t\, d\Delta T/dt)$ vs $\log t$ using the same data, no sharp cutoff is seen as would be the case for an exponential decay of PA.

We conclude that in our samples of *a*-Si:H it is essential to take into account the role of dangling bonds as observed in other studies on *a*-Si:H as well (for example, Street[4] and Conrad, Pandya, and Schiff[5]). Zeldov and Weiser's approach may be applicable to materials with very low density of deep traps.

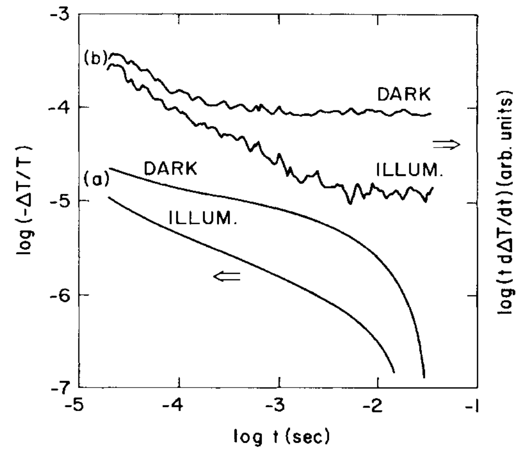

FIG. 1. (a) Decay of PA signal ΔT with and without bias (left-hand scale). (b) Decay of $t\, d\Delta T/dt$ with and without bias (right-hand scale).

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