**Introduction**


We investigated the SWE & its dependence on the number of incident photons in mixed-phase a-Si:H thin films embedded with germanium nanocrystals (nc-Ge/a-Si:H).

**Setup & Methods**

Sample was mounted on a temperature-controlled copper heating block inside a metal vacuum chamber. During dark current measurements, the glass part was covered with a tinfoil sheet.

Used cumulative illumination method for each data acquisition:
- Glass part was alternately being left at dark and illuminated while measuring the current.
- Neutral density filters were applied to reduce intensities.
- Sample was annealed in between acquisitions.

**Conclusion**

We studied the dependence of the SWE on the number of incident photons in nc-Ge/a-Si:H thin film samples by varying the light exposure length and light intensity.

In both samples, \( \sigma_B - \sigma_A / \sigma_A \) increased in power law fashion with exponents ~0.3-0.4 up to \( \# \) photons / area ~10^3 J/m^2, then started to roll off at higher number of photons, consistent with the constraint \( \sigma_B > 0 \).

The sample with higher nc-Ge crystal fraction had systematically lower fractional decreases of the dark conductivity than the sample with lower nc-Ge crystal fraction.

The latter result might suggest that the samples with higher nc-Ge crystal fractions may be more resistant to light-induced defects created by incident photons. Further studies involving more samples with broader range of nc-Ge crystal fractions are required to confirm this hypothesis.

**Results**

Complete current vs. time plot of the cumulative illumination method.

For all data acquisitions, 7 different cumulative light exposure lengths were used: 10 s, 100 s, 16 min, 0.5 hour, 1 hour, 3 hours, and 5 hours.

Reductions of both conductivities were observed, consistent to the SWE.

In both samples, \( \sigma_B - \sigma_A / \sigma_A \) followed power law trend for lower \( \# \) of photons / area up to \( \sim 10^3 \) J/m^2. The sample with 2.4% nc-Ge showed systematically smaller \( \sigma_B - \sigma_A / \sigma_A \) than the 2.2% nc-Ge sample, which might suggest that the samples with higher nc-Ge crystal fraction have lower fractional reduction of the dark conductivity, and hence might be less prone to having light-induced structural defects.

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**References**
