Evidence of Buried Junctions in CdSeTe Absorbers

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Research Goals and Motivation

The introduction of Selenium into CdTe devices has led to improved device performance. Previous work has suggested that introducing Selenium into CdTe during layer deposition should avoid crystallographic phase changes which decrease device performance. The purpose of this study was to measure how as-deposited Selenium concentration affected carrier collection across a CdSe_xTe_(1-x)/CdTe device via Electron Beam Induced Current (EBIC)

EBIC Imaging

- Electron Beam generates charge carriers in a PV devices
- Excess charge carriers are measured as a function of beam position
- Similar beam currents and voltages are used for all images

Sample Growth

- Inverted Structure
- MgZnO TCO
- 1um CdSeTe
- 5um CdTe
- Cu Doped
- CdCl Treated

Injection Normalized EBIC Maps

Collection current normalized to injection conditions (.43+/- .03 nA)
Red line is an averaged line profile of the collection

Rapid change in collection profile is seen between 0 and 10% Selenium deposited in the alloy layer

- High Local variance in microstructure gets washed out in large area line profiles

Possible Interpretations

1. Buried Junction
 - Selenium concentration affects both band gap and affinity of CdSeTe
 - Qualitatively experimental line profiles agree with simulated line profiles of buried p-i-n junctions
 - Model does not take into account grain boundary
2. Dopant Aggregation
 - Charged dopants at the line profile could cause a strong field.
 - This supports the strong collection contrast seen at the grain boundaries.

Conclusion

A novel collection profile was observed in CdSeTe devices. This collection profile changes with selenium concentration and requires further study.

Future Work

There is correlative study of which uses EBIC, Auger spectroscopy, and TEM to study the electrical, chemical, and structural properties of the device to better understand the results.

There is another study in which temperature and voltage bias are applied to EBIC measurements to better understand how this profile changes with external conditions