Dilute Nitride (GaInNAs) Solar cells

Hannah Harrell

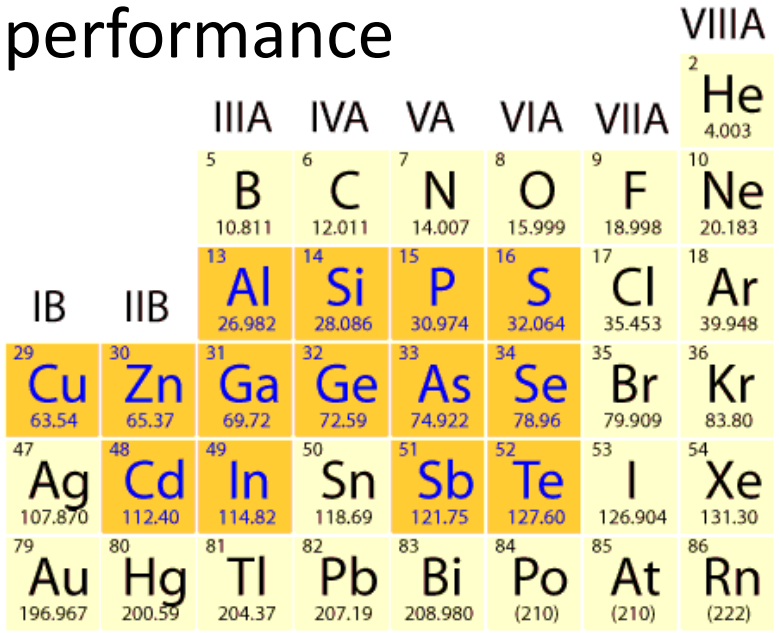
With Collin Brown

Under Dr. Ian Sellers

Solar cell efficiency

Single Junction

- Efficiency 25-30%
- Single material
- Limited performance



Multi Junction

- Efficiency 45%
- Multiples materials
- Wider range of energy collected
- Requirements:
  - Must have high quality material
  - Matching lattice material

Dilute nitride solar cell and passivation

Nitrogen

- Lattice matching
- Lowers band gap
- Control band gap with Indium
- Want band gap of 1 eV
- Reduced performance

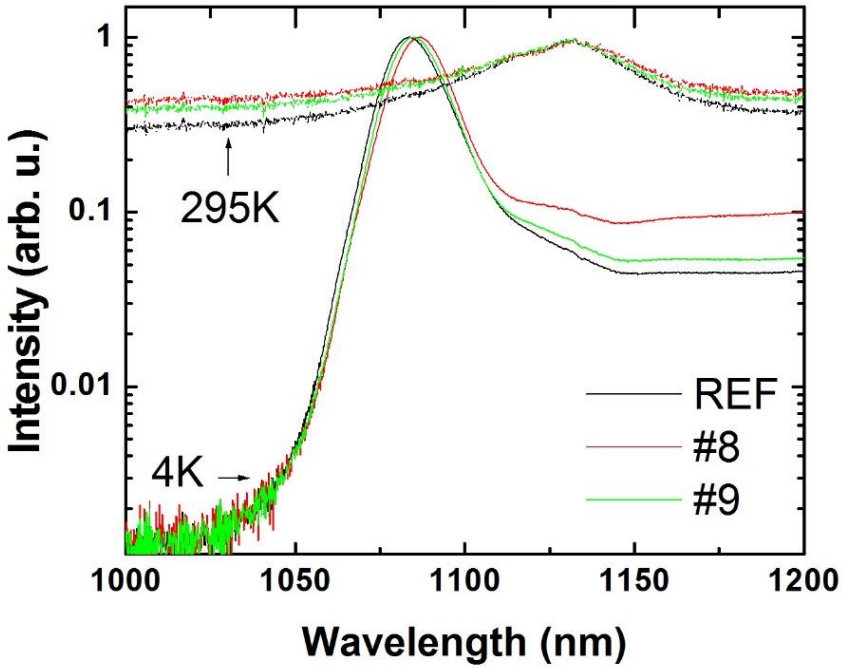
Passivation

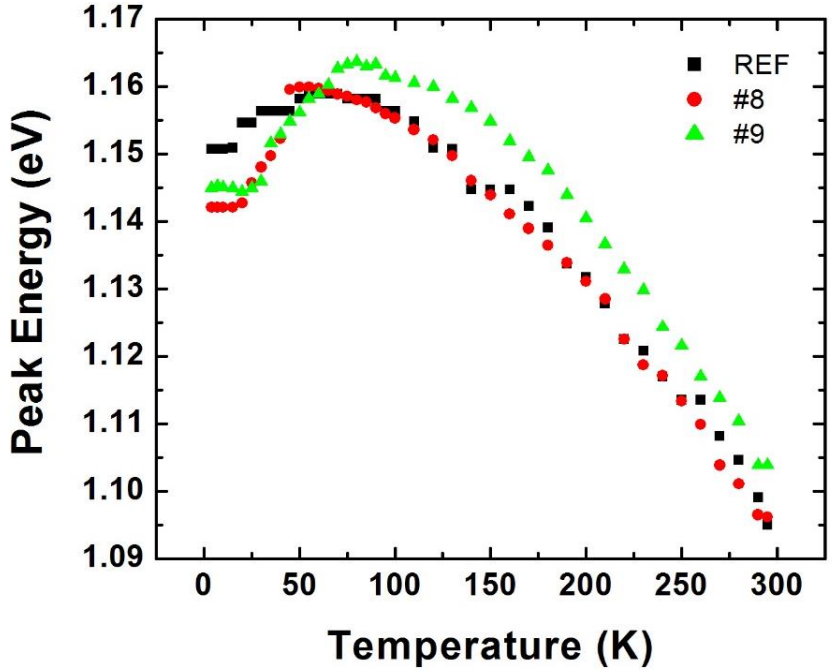
- Rapid thermal annealing
  - Effects atom configuration
- Hydrogenation
  - Neutralization of defects
- Removes effects of impurities

Photoluminescence PL

- Input light
- Produces light
- Measure intensity throughout the cell

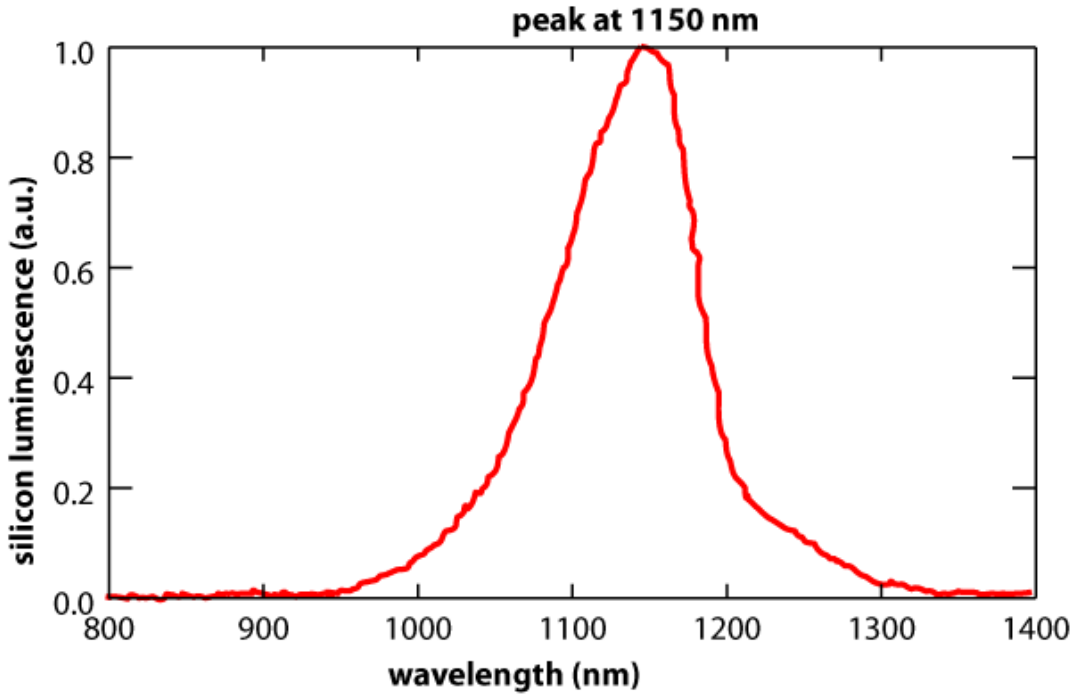
Temperature dependent photoluminescence





Electroluminescence EL

- Input current
- Produces light
- Measure intensity across active region



Quantum Efficiency QE

- EQE ↑, external losses ↓, carrier extraction efficiency ↑
- Tells us about absorption within the cell
  - What light is and is not being absorbed
- Ideally: EL + QE = 100