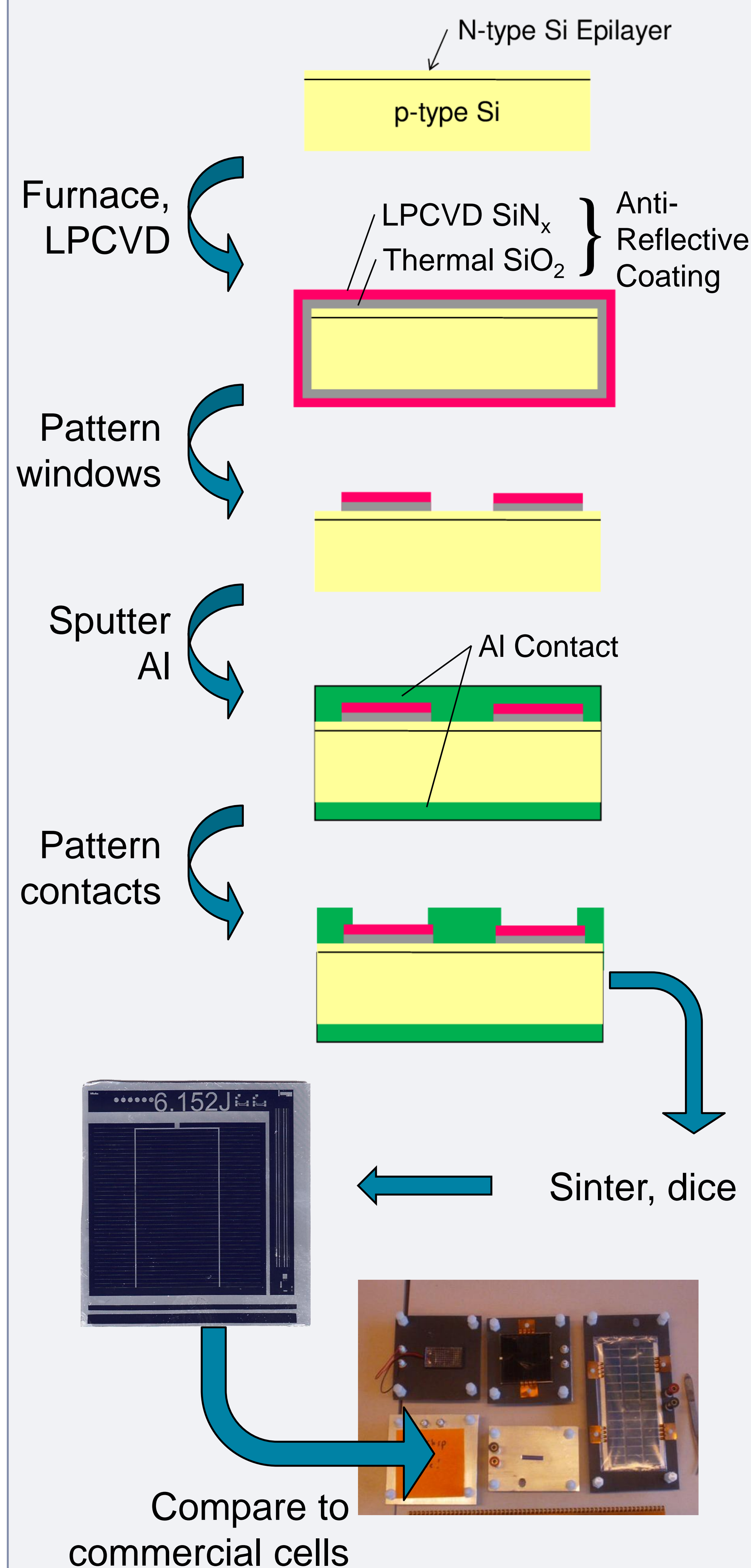


Objectives

- Fabricate a monocrystalline silicon solar cell
- Characterize the cell and process variability
- Compare efficiency with commercial solar cells

Fabrication

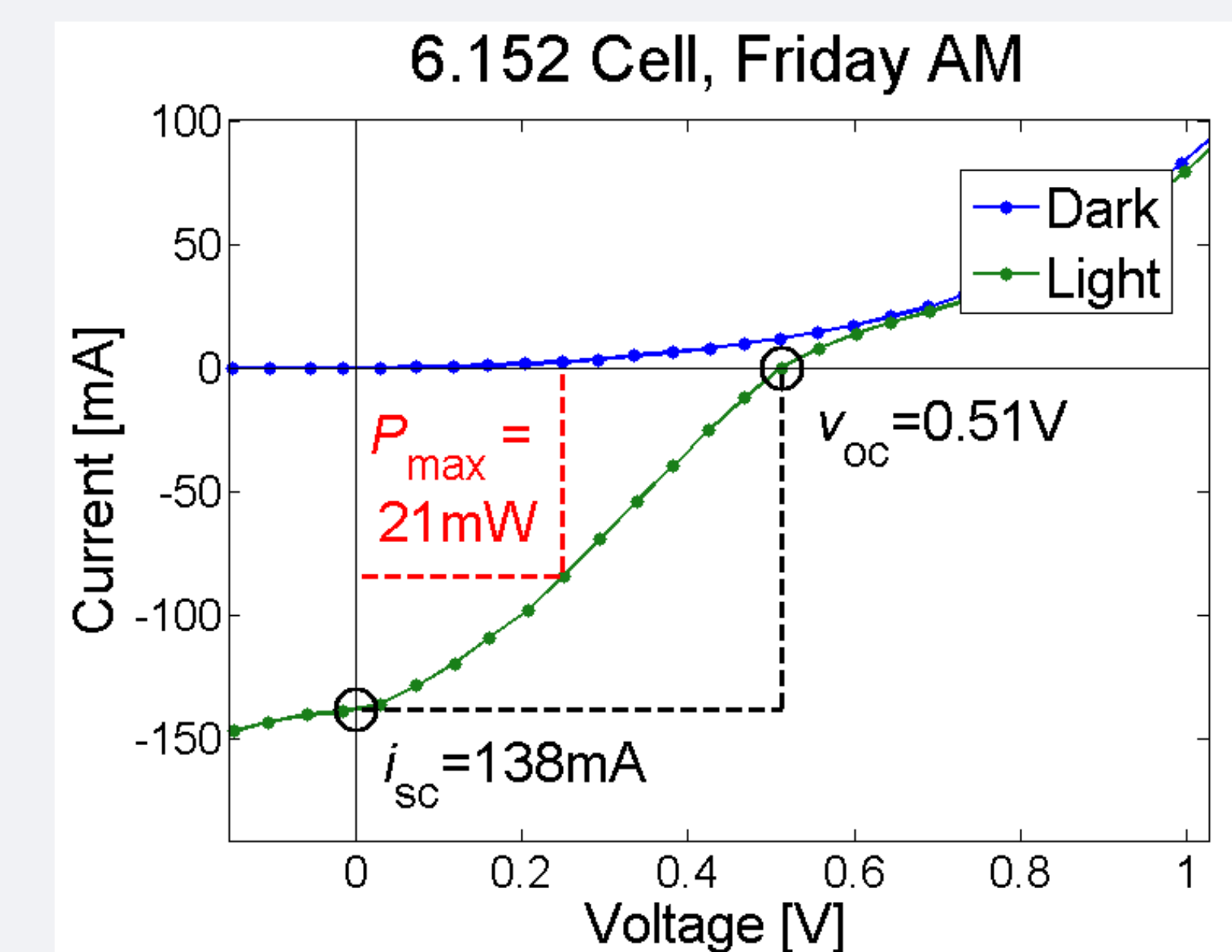


Testing

- Mount cell above window of light source
- Collect dark and illuminated I-V curves
- Cells tested:
 - 6.152 mono-Si epi-junction cell ("6.152")
 - 2" x 2" solar cell ("2x2")
 - Encased Si solar cell ("Si")
 - GaAs (III-V) solar cell ("GaAs")
 - Thin film solar cell ("Thin Film")
- Five distinct "6.152" cells created with the same process and characterized by different groups.
- Commercial/research cell error bounds reflect only variation in measurements.
- 6.152 cell error bounds reflect variation in measurements **and processing**.

Analysis

- Illuminated I-V curves numerically interpolated:
 - short-circuit current
 - open-circuit voltage
 - maximum power point
- Fill factors and power per area then computed.



- Final values averaged from each of the five groups
- Error bars are extracted from the standard deviation

Conclusions

The quality of the product:

The 6.152 cell is competitive with the 2x2 and thin film cell (purely in terms of efficiency), but not the commercial Si or III-V cell.

The process variability:

Process variation is not a significant concern at the precision of this experiment.

Future research

Experimental directions

- Account for spatial variation in light source intensity
- Vary lighting conditions, compare efficiencies
- Measure heating and temperature response

Cell design considerations

- Move n-side contacts to rear [1]
- Texturize window layer to reduce reflection [2]

References

- [1] Lammert, M.D.; Schwartz, Richard J., "The interdigitated back contact solar cell: A silicon solar cell for use in concentrated sunlight," *IEEE Transactions on Electron Devices*, vol. 24, no. 4, pp. 337-342, April 1977.
- [2] Deinega et al, "Minimizing light reflection from dielectric textured surfaces," *J. Opt. Soc. Am. A*, vol. 28, no. 5, pp. 770-776, May 2011.

Acknowledgements

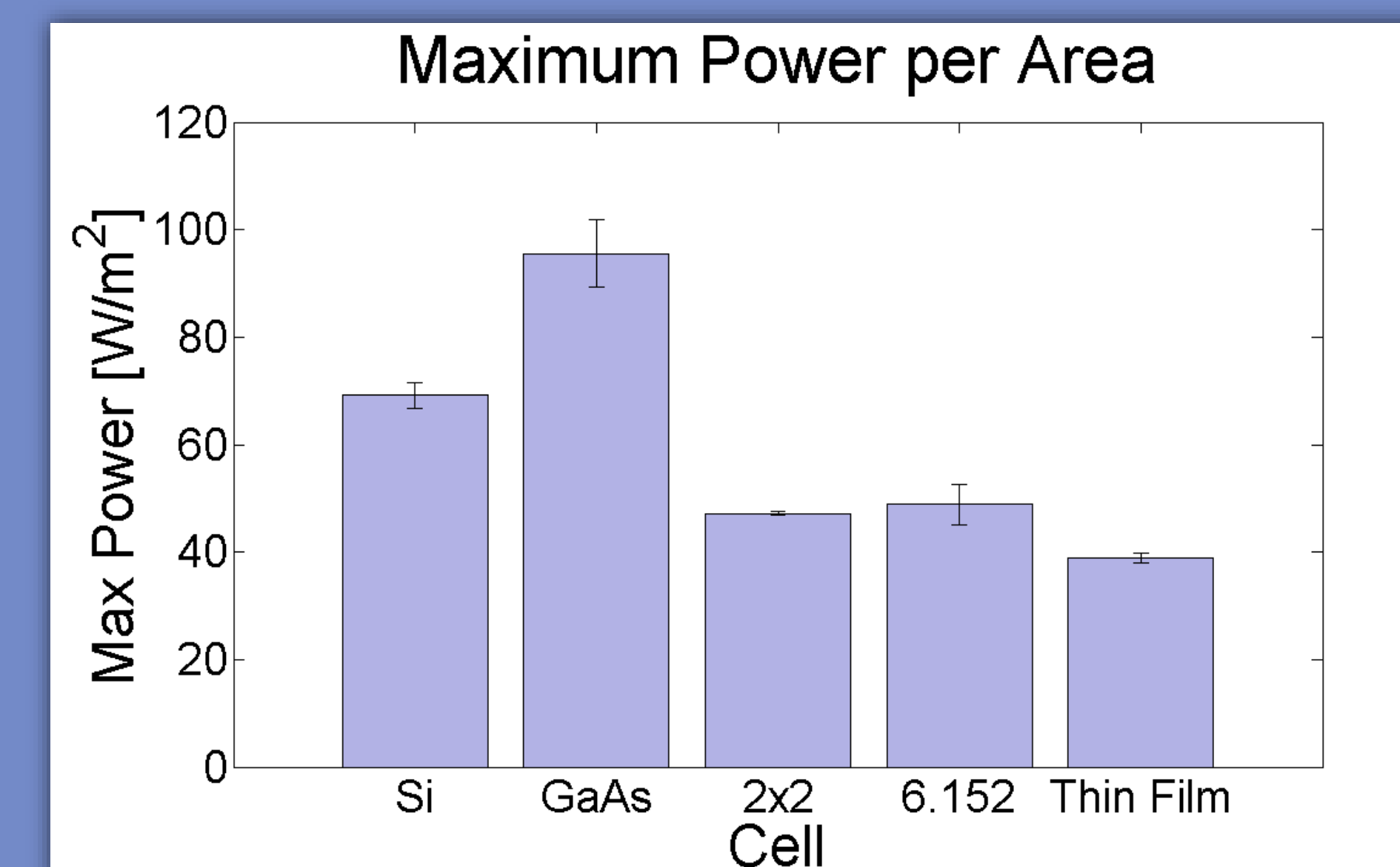
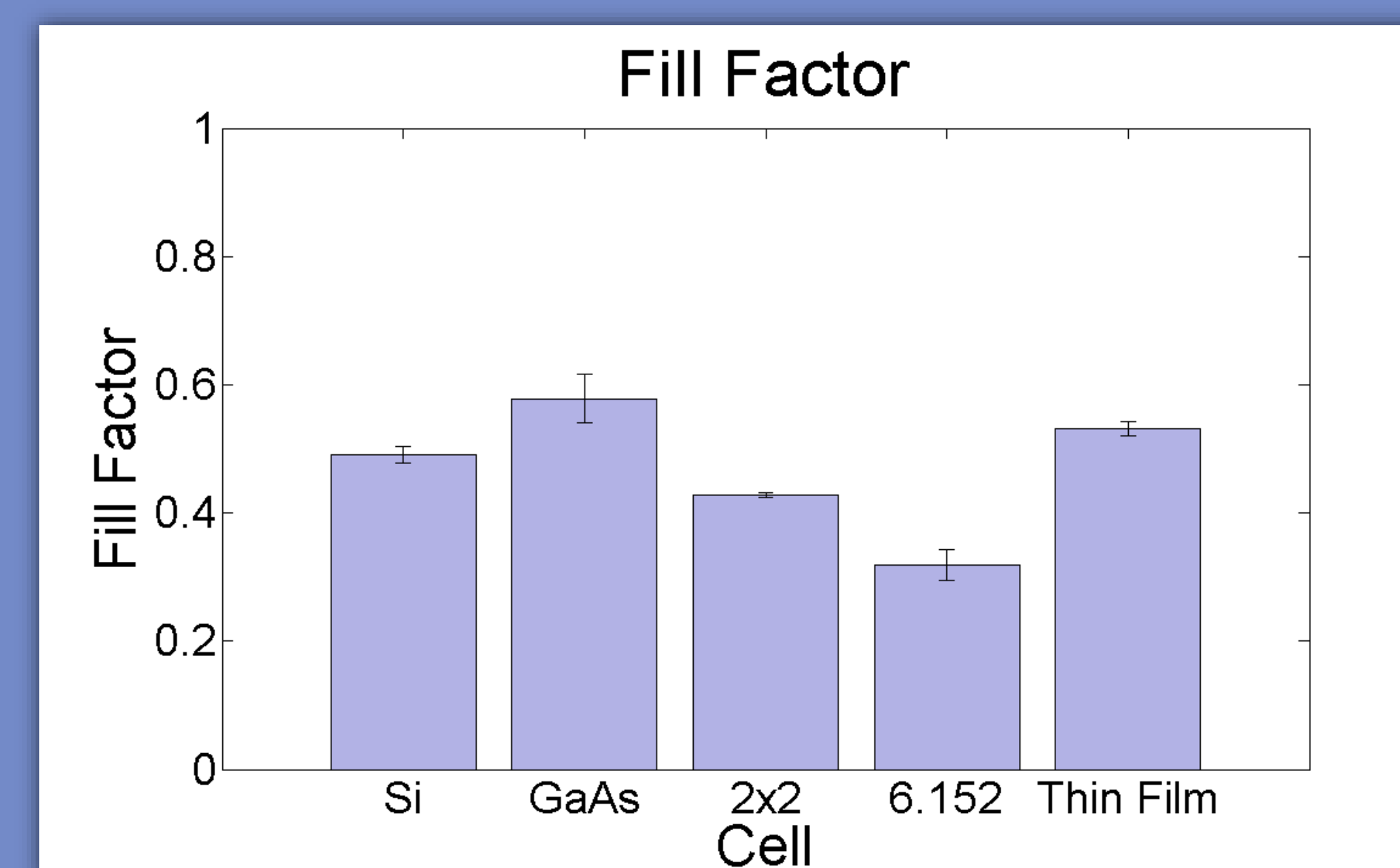
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Contacts

- Sam Bader: sbader@mit.edu
- Jordan Goldstein: jordango@mit.edu

Results

Intrinsic Figures of Merit



Extrinsic Cell Characterizations

