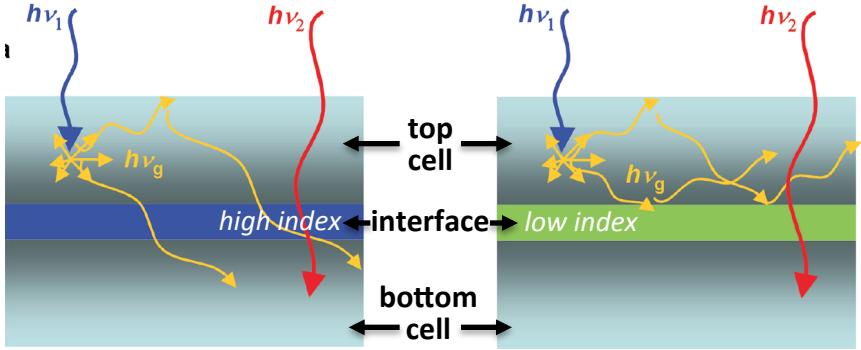
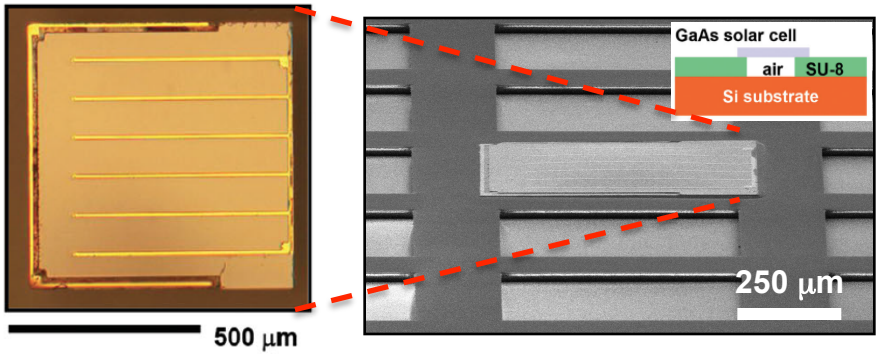
Enhanced Photon Recycling in Multijunction Solar Cells

Photon dynamics in multijunction solar cells: Low-index interface enables photon recycling



GaAs microscale solar cell (top view)

GaAs microscale solar cell printed on a Si substrate with an air gap interface (tilted view)



X. Sheng, M.H. Yun, C. Zhang, A.M. Al-Okaily, M. Masouraki, L. Shen, S. Wang, W.L. Wilson, J.Y. Kim, P. Ferreira, X. Li, E. Yablonovitch, and J.A. Rogers, "Device Architectures for Enhanced Photon Recycling in Thin-Film Multijunction Solar Cells." *Adv. Energy Mater.* (2014). DOI: 10.1002/aenm.201400919

Scientific Achievement

We demonstrate improved multijunction (MJ) solar cell performance by incorporating a low refractive index interface between subcells, enabling enhanced photon recycling.

Significance and Impact

Advanced photon management in this new device design can be applied to practical multijunctions for high-efficiency full-spectrum cell operation while eliminating lattice and current matching requirements.

Research Details

- Vertically stacked architecture is realized by epitaxial liftoff and transfer printing, avoiding complexities in design associated with other spectral splitting methods.
- Released thin-film GaAs micro cells are printed on structures with low-index air and SU-8 interfaces.
- These devices exhibit enhanced photon recycling and increased open-circuit voltage.

Work was performed at UIUC and Berkeley