ASU LightWorks
ARIZONA STATE UNIVERSITY
Light-Inspired Solutions

Partnerships

arpa·e

Georgia Institute of Technology

PHOTONITRIDE DEVICES, INC

SUNVAPOR
RENEWABLE PROCESS HEAT

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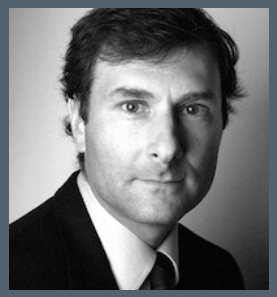

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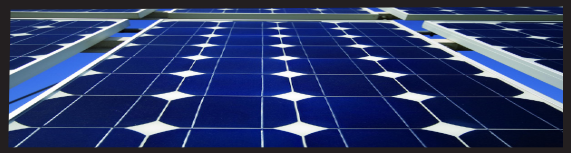
High Temperature InGaN Thermionic Topping Cells

Hybrid PV/CSP solution for dispatchable energy at low cost

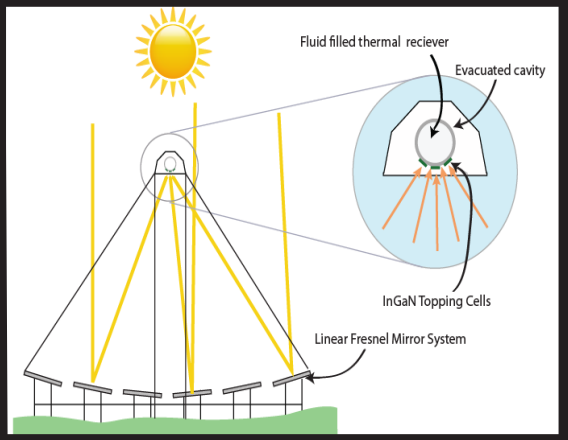
ASU LightWorks

ARIZONA STATE UNIVERSITY

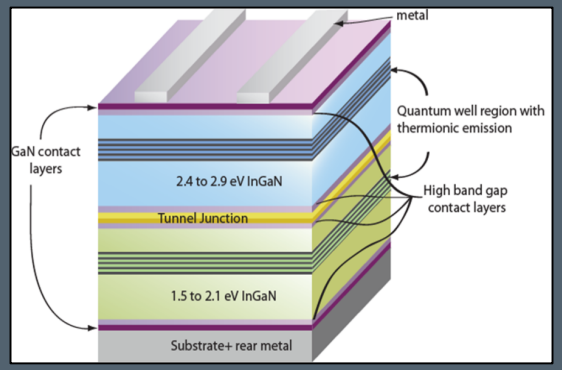
LightWorks is an Arizona State University initiative that inspires and develops ways to revolutionize the use of energy and the large scale conversion of sunlight, carbon dioxide and water into useful products. We support creation of new industries not just to power the world, but to empower it; not just to create wealth for a few, but to enrich people's lives everywhere; not just to light an energy revolution, but to enlighten communities across the globe; not just to achieve energy security but to secure energy justice.
www.asulightworks.com



A team consisting of Arizona State University, Georgia Institute of Technology, PhotoNitride Devices and SunVapor are working together to create a two-junction tandem InGaN solar cell which can operate under high temperatures and solar concentration in parallel with a solar thermal system. InGaN was chosen because of its tunable bandgap and its robustness at elevated temperatures. This "topping cell" will incorporate with a solar-thermal system, resulting in higher overall system efficiency at lower overall cost per watt.

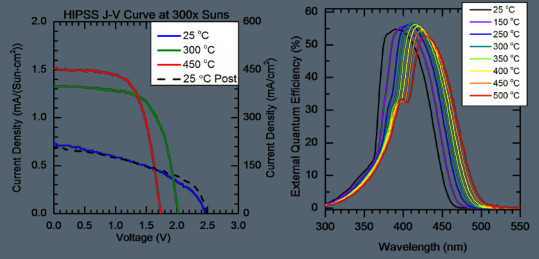


PVMirror combines PV and CSP systems to achieve an affordable and efficient energy storage solution.



What is the technology?

- **A two junction InGaN based tandem solar cell operating up to 450 C**
- **Advanced device structures and fabrication methods such as refractory metal contact metallurgy with low specific contact resistance and all nitride based semiconductor components**
- **Heterostructure carrier selective contact structures with a multi-quantum well (MQW) absorber layer to increase Voc and relax doping requirements while maintaining photocarrier collection through thermionic escape from the quantum wells.**



How does it work?

The High Temperature InGaN Thermionic Topping Cells project uses the established technology from the multi-billion dollar LED industry to reduce the cost of this emerging material for PV. This translates to a decreased CSP-CPV system cost per watt.

Potential Impacts:

- **There is a strong need for dispatchable, low-cost, renewable energy at the utility-scale.**
- **Solar thermal systems allow for dispatchable energy, but at increased cost per watt.**
- **A Hybrid CSP-CPV system allows for higher efficiency at a lower overall cost per watt, with the advantage of dispatchable power.**
- **The key challenge in achieving this is to create a low-cost solar cell that works efficiently at the high temperatures of CSP systems.**