

# Scientists demonstrate new semiconductor material for solar cell technology

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The University of Liverpool is part of an international research team that have demonstrated a new semiconductor material made from abundant elements which can be "tuned" for use in solar cells instead of rare

elements.

Semiconductors are vital to the electronics industry and are used in everything from smart phones to solar panels but they rely on [rare elements](#) such as tellurium, gallium and indium and there is increasing concern over their cost and availability.

Researchers focussed on the compound zinc tin nitride ( $\text{ZnSnN}_2$ ) which has been recently synthesized by research groups around the world, using zinc and tin – metals which are readily available through mature recycling facilities – rather than expensive and rare metals.

Working with the compound, they discovered an innovative tuning process which means it could provide a possible replacement for semiconductor material currently used in solar cells.

It had been thought that the band gap (a semiconductor's defining characteristic) was too large for device applications such as [solar cells](#). However, the researchers found that the alloy's band gap can be "tuned" by altering the perfectly ordered crystalline lattice by introducing disorder in the form of randomly distributed zinc and tin atoms.

Dr Tim Veal, a reader in Physics and researcher in the University of Liverpool's Stephenson Institute for Renewable Energy, said: "Such tuneability is typically achieved in other material systems by alloying, or blending in other elements, to obtain the desired result, However, this is not necessary with  $\text{ZnSnN}_2$ , given the recent discovery."

Dr Steve Durbin, Professor and Chair of Electrical and Computer Engineering at Western Michigan University, added: "We use a sophisticated crystal growth technique known as [molecular beam epitaxy](#) . It allowed us to control crystal quality by carefully adjusting parameters such as temperature and the ratio of incident atomic (or molecular)

beams."

Dr Veal added: "By doing so, the team has been able to observe a wide range of disorder in a number of samples, and correlated this with a significant reduction in [band gap](#) energy – paving the way for this material to be considered for solar cell applications."

The research, funded by the UK Engineering and Physical Science Research Council and US National Science Foundation, is published in the journal *Advanced Energy Materials*.

**More information:** Tim D. Veal et al. Band Gap Dependence on Cation Disorder in ZnSnN<sub>2</sub> Solar Absorber , *Advanced Energy Materials* (2015). [DOI: 10.1002/aenm.201501462](https://doi.org/10.1002/aenm.201501462)

Provided by University of Liverpool

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