Myth-busting research into a new alternative solar cell material could lead to cheaper solar cells

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Solar cells that are cheaper and easier to manufacture could challenge the dominance of silicon, with new research showing an alternative material called perovskite is more efficient and adaptable than previously thought.

The challenge to developing efficient and cheap commercially available solar panels has, until now, been dominated by silicon, with emerging alternative solar cells considered minor players, says Wei Lin Leong from the A*STAR Institute of Materials Research and Engineering.

"Silicon is very labor-intensive and requires very high temperatures to process," Leong explains. "But with alternative cells there is inefficiency in capturing the energy from the Sun".

Perovskite is relatively easy to process, and therefore cheaper to manufacture, but also has an efficiency of 22 per cent, close to silicon cells' 25 per cent.

Yet, the dominance of commercial and research investment in silicon has made it difficult to convince researchers and commercial developers to adopt new technology.

"This new class of solar cell is only around four years old, so although it has high performance, people don't understand the system and why it's

doing so well," Leong says.

Her research has provided important insights into the basic physics of perovskite solar cells by measuring their efficiency at different temperatures and light intensities1.

"Because it had only been tested at room temperatures, people were skeptical about whether it would still work at the higher temperatures under direct sunlight on a rooftop, where it can go up to 60 degrees Celsius," Leong says.

For most conventional or silicon-based solar cell technologies, efficiency worsens as temperature rises.

Leong's study showed the perovskite cells still worked at higher temperatures, with performance peaking at around 330 Kelvin—or 57 degrees Celsius—and then declining slightly after that, meaning their performance will be high even on a relatively hot rooftop. It also showed that, contrary to arguments made by some critics, the material was highly efficient at collecting charge through electrodes.

Leong believes that perovskite will eventually challenge silicon commercially. "In terms of efficiency, perovskite is already close and it can be made much more cheaply," she says.

However, perovskite cells still contain lead, which means more research needs to be done to ensure the lead does not leak. "Another big challenge is to make cells big enough for commercial use, as right now all the research is on small cells," she says.

More information: Wei Lin Leong et al. Identifying Fundamental Limitations in Halide Perovskite Solar Cells, *Advanced Materials* (2016). DOI: 10.1002/adma.201505480