Eco-friendly solar cells set new world record

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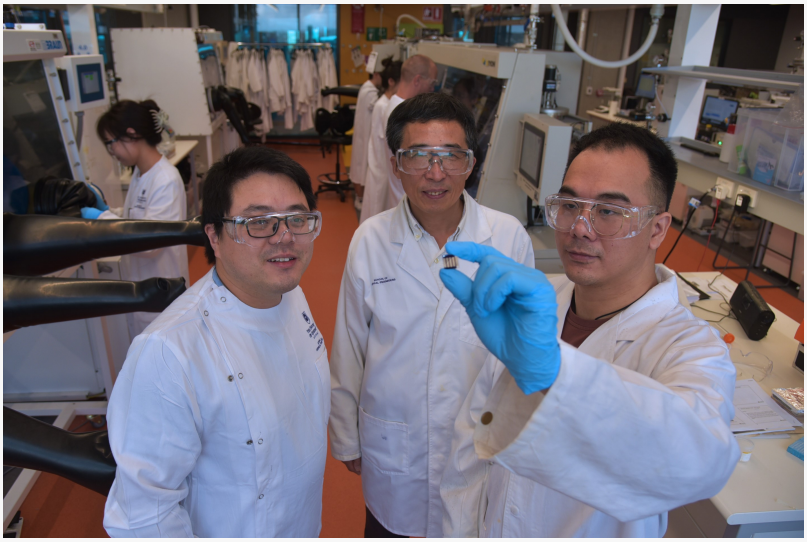

From Left to Right: Dr Peng Chen, Professor Lianzhou Wang & Dongxu He

BRISBANE, QUEENSLAND, AUSTRALIA, April 17, 2025 /EINPresswire.com/ -- Researchers at The University of Queensland have set a new world record efficiency for lead-free perovskite solar cells, advancing the development of safer, more sustainable solar technologies.

A team led by Professor Lianzhou Wang, based at the Australian Institute for Bioengineering and Nanotechnology (AIBN) and the School of Chemical Engineering, achieved a breakthrough certified efficiency of 16.65 per cent using tin-based perovskite - a non-toxic alternative to the lead typically used in next-generation solar cells.

“This is a major milestone for the field,” Professor Wang said.

“To achieve such a high efficiency with tin perovskites, a non-toxic material, demonstrates the potential to deliver solar technologies that are both high-performing and safer for people and the planet.”

Researchers began exploring perovskite materials as a cheaper, more efficient alternative to traditional silicon-based solar cells, with lead-based versions offering some of the strongest early results, achieving impressive efficiencies over 25 per cent.

Their reliance on toxic lead has raised serious concerns around environmental safety and disposal, prompting efforts to search for more eco-friendly alternatives.

“Lead-based perovskites have long delivered high efficiencies, but lead is highly toxic and can potentially cause severe environmental pollution,” Professor Wang said.

“Our results using tin shows that we can offer a safer path forward - without the need for lead and without significantly compromising performance.”

The tin-based solar cells build on the team’s previous world record using quantum dots, with the new eco-friendly material achieving energy efficiency one step closer to that of lead and silicon counterparts.

“Efficiency has always been the biggest hurdle with tin,” Professor Wang said.

“Now we’re narrowing that gap and opening the door to a new generation of solar technologies that are not only safer, but also more versatile.

“With further improvements, we could see flexible solar panels, indoor applications, and lightweight devices powered by our clean, lead-free energy – possibilities that aren’t fully achievable with lead-based materials.”

While the result represents a global benchmark, the team says further work is needed to optimise the technology for long-term use.

AIBN researcher Dr Peng Chen said the team’s breakthrough was made possible by carefully controlling how the tin material forms during fabrication.

“Tin is much less stable than lead as it reacts easily with oxygen and degrades, which reduces the cell’s performance and operational life,” Dr Chen said.

“By using a colloidal chemical strategy with caesium, we were able to control how the material forms and make better-quality tin solar films that allowed us to achieve our more efficient and durable tin-based cells.

“This record shows that we’re overcoming some of the key barriers of using tin, but further improvements in stability and efficiency will be key to unlocking its commercial use.”

The team – including AIBN researcher Dongxu He – will now focus on enhancing the durability of tin-based cells and refining production techniques to support scalable, real-world use including flexible panels and low-light-intensity indoor systems.

The research was supported by an ARC Laureate Fellowship, Discovery Project, and DECRA Fellowships, with additional contributions from the University of New South Wales and Australian National University.

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