Solar discovery sets new record for low-grade silicon

May 6 2013

(Phys.org) —Solar engineers from UNSW have developed an innovative method to dramatically improve the quality of low-grade silicon, promising to significantly improve electrical efficiency and reduce the cost of solar panels.

The UNSW team has discovered a mechanism to control hydrogen atoms so they can better correct deficiencies in silicon – by far the most expensive component used in the making of solar cells.

"This process will allow lower-quality silicon to outperform solar cells made from better-quality materials," says Scientia Professor Stuart Wenham from the School of Photovoltaics and Renewable Energy Engineering at UNSW.

Standard commercial silicon cells currently have a maximum efficiency of around 19%. The new technique, patented by UNSW researchers earlier this year, is expected to produce efficiencies between 21% and 23%, says Wenham.

"By using lower-quality silicon to achieve higher efficiencies, we can enable significant cost reductions," he says.

The solar industry has long been focused on bringing down the cost of silicon. However, cheaper silicon also means lower-quality silicon, with more defects and contaminants that reduce efficiency.

It's been known for several decades that hydrogen atoms can be introduced into the atomic structure of silicon to help correct these defects, but until now, researchers have had limited success in controlling the hydrogen to maximise its benefits or even understanding why this happens.

"Our research team at UNSW has worked out how to control the charge state of hydrogen atoms in silicon – something that other people haven't previously been able to do," says Wenham.

Hydrogen atoms can exist in three 'charge' states – positive, neutral and negative. The charge state determines how well the hydrogen can move around the silicon and its reactivity, which is important to help correct the defects.

"We have seen a 10,000 times improvement in the mobility of the hydrogen and we can control the hydrogen so it chemically bonds to things like defects and contaminants, making these inactive," says Wenham.

The UNSW team currently has eight industry partners interested in commercialising the technology, and is also working with manufacturing equipment companies to implement the new capabilities.

The project, which has been generously supported by the Australian Renewable Energy Agency, is expected to be completed in 2016. UNSW still holds the world-record for silicon cell efficiency at 25%.

Provided by University of New South Wales