Researchers make breakthrough in renewable energy materials

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University of Queensland researchers have made a ground-breaking discovery that produces highly efficient miniature crystals which could revolutionise the way we harvest and use solar energy.

Professor Max Lu, from UQ's Australian Institute for Bioengineering and Nanotechnology (AIBN), said they were one step closer to the holy grail of cost-effective solar energy with their discovery.

“We have grown the world's first titanium oxide single crystals with large amounts of reactive surfaces, something that was predicted as almost impossible,” Professor Lu said.

“Highly active surfaces in such crystals allow high reactivity and efficiency in devices used for solar energy conversion and hydrogen production.

“Titania nano-crystals are promising materials for cost-effective solar cells, hydrogen production from splitting water, and solar decontamination of pollutants.

“The beauty of our technique is that it is very simple and cheap to make such materials at mild conditions.

“Now that the research has elucidated the conditions required, the method is like cooking in an oven and the crystals can be applied like paints.”

Professor Lu, who was recently awarded a second prestigious Australian Research Council Federation Fellowship, said it wasn't just renewable energy where this research could be applied.

“These crystals are also fantastic for purifying air and water,” he said.

“The same principle for such materials to convert sunlight to electricity is also working to break down pollutants in water and air.

“One could paint these crystals onto a window or a wall to purify the air in a room.

“The potential of applications of this technology in water purification and recycling are huge.”

Professor Lu said it would be about five years for the water and air pollution applications to be commercially available, and about 5 to 10 years for the solar energy conversion using such crystals.

He said the breakthrough technology was a great example of cross-discipline collaborations with work by Professor Sean Smith's Computational Molecular Science group at AIBN, who conducted key computational studies and helped the experimentalist researchers to focus on specific surface modification elements for control of the crystal morphology.

“First-principle computational chemistry is a powerful tool in aiding the design and synthetic realisation of novel nanomaterials, and this work is a beautiful example of the synergy,” Professor Smith said.

Professor Lu said the work was also the result of a very fruitful and long-term international collaboration with Professor Huiming Cheng's group from the Chinese Academy of Sciences, a world-class institution with

which UQ has many productive research collaborations.

The research, which was produced with colleagues Huagui Yang, Chenghua Sun, Shizhang Qiao, Gang Liu, Jin Zou, has been published in the latest edition of scientific journal *Nature* (doi:10.1038/nature06964).

Source: UQ