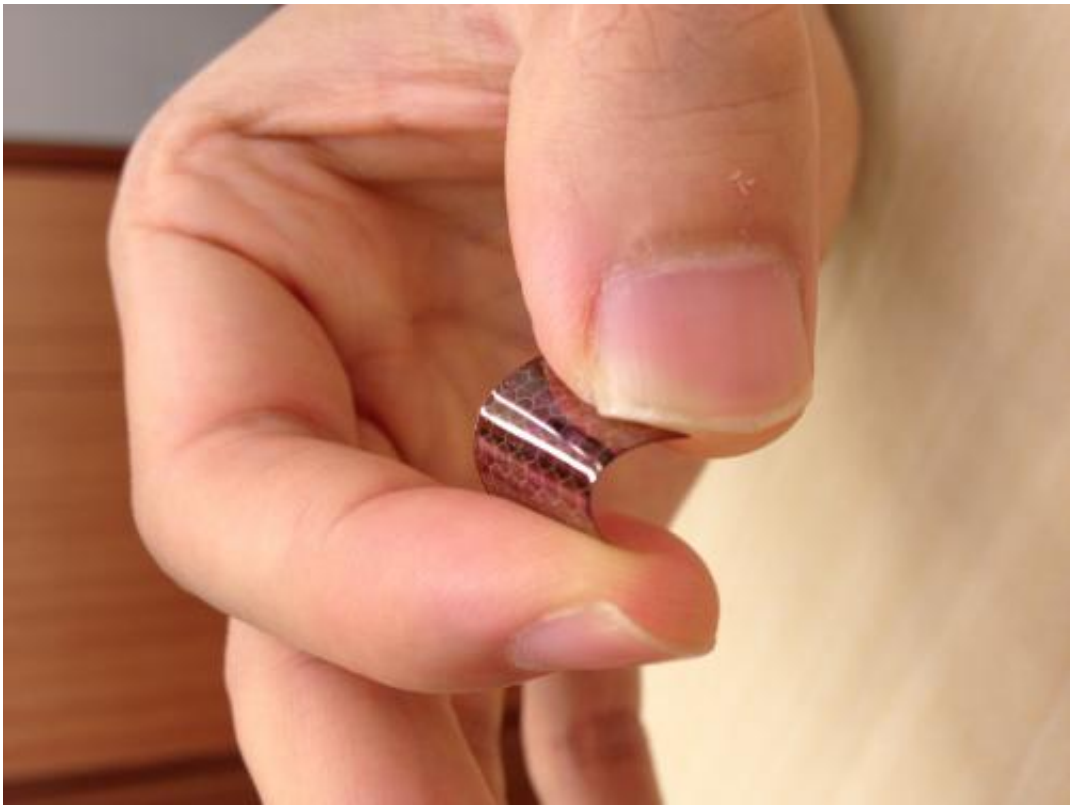
One step closer to low cost solar cells

January 27 2014, by Kathleen Estes



The flexible transparent electrode - “Flextrode.”

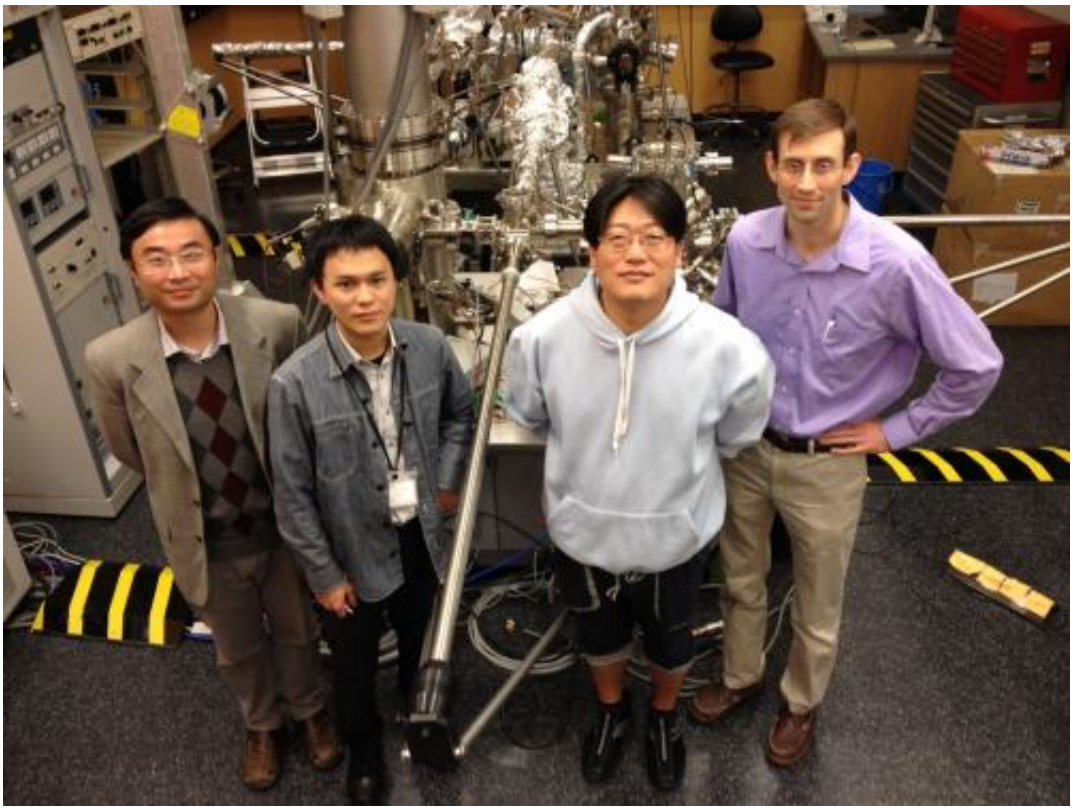
The dwindling resources for conventional energy sources make renewable energy an exciting and increasingly important avenue of research. However, even seemingly new and green forms of energy production, like silicon-based solar cells, are not as cost effective as they could be. An OIST research team led by Yabing Qi is investigating solar cells based on organic materials that have electrodes both flexible and

transparent, enabling the fabrication of these solar cells at a low cost. In a recent paper published in the journal *Organic Electronics*, Qi and his research group characterized the electrodes made with new materials, including plastic, conductive material and zinc oxide. They also successfully identified methods by which to clean the electrodes to restore their conductivity and work function after an extended period of storage, thus contributing to the optimization of making these new solar cells.

Traditional silicon-based solar cells are expensive to make because of the cost of the raw materials and stringent fabrication requirements. Silicon-based solar cells are also rigid and opaque, meaning their usage and placement are limited. Qi and colleagues work with flexible conductive materials that are also transparent. The fabrication of the "Flextrodes," as these flexible transparent electrodes have been named, is more cost effective and potentially easier to fabricate using a method called roll-to-roll coating, due to their flexible nature. For example, the main component for fabricating Flextrodes is PET, the same inexpensive and readily available plastic that comprises disposable drink bottles. In addition, their use and placement is potentially much more diverse than the silicon cells. For example, they may even be placed on windows since the organic solar cells can be made partially transparent.

Since these Flextrodes are a relatively new technology, basic surface science studies had not been conducted. In their recent paper, Qi and colleagues looked at their work function, surface conductivity and chemical states. They also observed that after an extended period of storage, Flextrodes had an insulating layer of contaminants on the surface that greatly reduced their efficiency and function. The researchers were able to show that two common cleaning methods, one using UV ozone treatment, the other using oxygen plasma treatment, were both effective in removing the contaminants and restoring function to the Flextrodes in a timely and cost-efficient way. The research

demonstrated that these methods could easily be integrated into the solar cell fabrication process to regenerate ready-to-use Flextrodes.



Qi research group that studies Flextrodes. From left: Yabing Qi, Yuichi Kato, Min-Cherl Jung and Michael Lee.

Qi is excited about the future of these low-cost organic solar cells. He explains that unlike conventional silicon-based solar cells, "the organic materials available to make the cells are virtually limitless." His lab is working on design and optimization of these new solar cells. The possibility of this technology being available for widespread public use may be just around the corner. Perhaps the next window decoration you put up will be one comprised of organic solar cells, providing not just nice aesthetics, but clean energy as well.

More information: Yuichi Kato, Min-Cherl Jung, Michael V. Lee, Yabing Qi, "Electrical and optical properties of transparent flexible electrodes: Effects of UV ozone and oxygen plasma treatments." *Organic Electronics*, Volume 15, Issue 3, March 2014, Pages 721-728, ISSN 1566-1199, dx.doi.org/10.1016/j.orgel.2014.01.002.

Provided by Okinawa Institute of Science and Technology