

## **Solar Frontier Breaks CZTS Cell Efficiency Record**

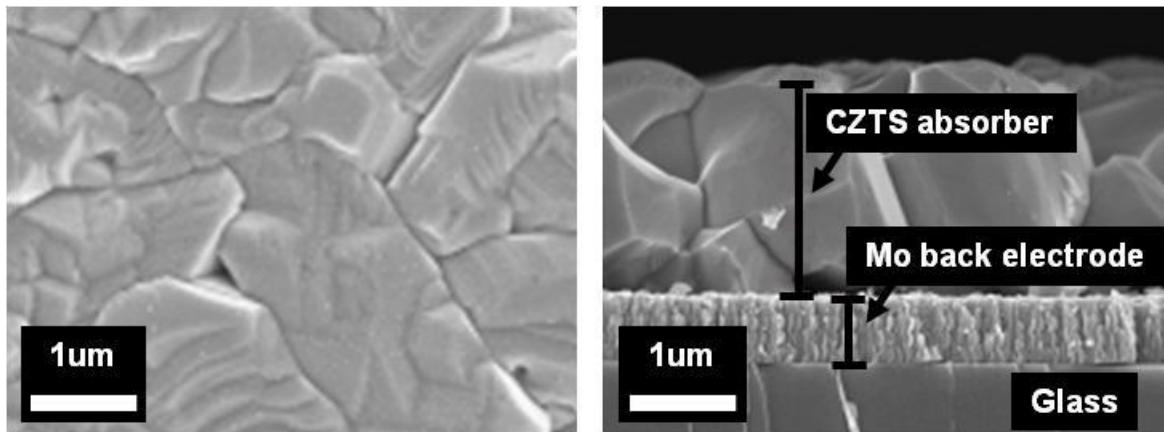
World-record 12.6% cell efficiency achieved with IBM and TOK

**Tokyo—December 10, 2012** —Solar Frontier announced today that it has set a new conversion efficiency record for CZTS solar cells (0.42cm<sup>2</sup>) at 12.6%. The latest world record was achieved in joint research with IBM (NYSE:IBM) and Tokyo Ohka Kogyo (TOK), and has been independently verified by Newport Corporation<sup>1</sup>. The details have been published in the *Advanced Energy Material*, journal on Nov 27<sup>2</sup>.

CZTS stands for key ingredients copper, zinc, tin, sulphur and selenium. Inexpensive and with abundant supply, these materials offer CZTS a cost-competitive advantage over other photovoltaic technologies. The new 12.6% world record eclipses the previous record of 11.1%, which was also set by Solar Frontier and its joint-research partners.

“Breaking our previous record at such a fast pace shows the potential of CZTS for mass production in the future, and we are now in a position to drive that efficiency even higher,” said Satoru Kuriyagawa, Chief Technology Officer of Solar Frontier.

Solar Frontier is the world’s largest provider of CIS thin-film photovoltaic solutions. Its Atsugi Research Center in Kanagawa, Japan, has also achieved standing world record conversion efficiencies of 17.8% on a 30cm by 30cm CIS submodule and 19.7% for non-cadmium CIS cell. Solar Frontier’s CIS modules, manufactured in Japan, are offered in commercial volumes at up to 13.8% efficiency, the highest of any mass produced thin-film modules.



Picture provided by IBM

<sup>1</sup> Newport Corporation provides advanced technology products and solutions, including photovoltaic conversion efficiency certification..

<sup>2</sup> <http://onlinelibrary.wiley.com/doi/10.1002/aenm.201301465/abstract>

**About IBM**

For more information, please visit [www.research.ibm.com](http://www.research.ibm.com)

**About TOK**

For more information, please visit [www.tok.co.jp/en/](http://www.tok.co.jp/en/)

**About Solar Frontier**

Solar Frontier K.K., a 100% subsidiary of Showa Shell Sekiyu K.K. (TYO:5002) ("Solar Frontier"), has a mission to create the most economical, ecological solar energy solutions on Earth. Building on a legacy of work in solar energy since the 1970s, Solar Frontier today develops and manufactures CIS (denoting copper, indium, selenium) thin-film solar modules for customers in all sectors around the world. Solar Frontier's gigawatt-scale production facilities in Miyazaki, Japan, integrate compelling economical and ecological advantages into every module: from lower energy requirements in manufacturing to the higher overall output (kWh) of CIS in real operating conditions. Solar Frontier is headquartered in Tokyo, with offices in Europe, the U.S.A., and the Middle East. Visit [www.solar-frontier.com](http://www.solar-frontier.com) for more information.

**Showa Shell Sekiyu K.K.**

Showa Shell Sekiyu K.K. is listed on the Tokyo Stock Exchange and has roots dating back more than 100 years in the downstream energy business.

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