

Manz AG: ZSW brings the world record in thin-film solar technology efficiency back to Germany

- The Manz research partner reinforced the technological advantages of the CIGS technology with a 22.6% degree of efficiency
- With exclusive access to leading world record technology, Manz has secured ongoing technological leadership in mechanical engineering for thin-film solar modules
- CIGS technology is already realizing the lowest costs for solar power through ongoing technological advances and has enormous potential for additional cost reduction at its disposal

Reutlingen, Tuesday, June 15, 2016 - With 22.6%, the Center for Solar Energy and Hydrogen Research Baden-Wuerttemberg (ZSW), Manz AG's exclusive research partner in the field of CIGS thin-film solar technology on glass, has brought the world record for CIGS thin-film solar cell efficiency back to Germany. It is the highest efficiency factor ever achieved in thin-film solar technology and significantly exceeds even the previous record held by today's market-leading multicrystalline silicon solar technology. The world record was officially confirmed by the Fraunhofer Institute for Solar Energy Systems ISE in Freiburg.

Dieter Manz, CEO and founder of Manz AG commented, "The new world record is an impressive result of efficient collaboration between the ZSW and Manz as an exclusive industry partner." With 22.6%, ZSW not only negated the last world record, but far surpassed it. This is with immense pride and is clear evidence that the CIGS thin-film technology has by far the greatest potential for further increasing the degree of efficiency and that we are far from the end of development. "In direct comparison to the multicrystalline technology, CIGS has a lead of 1.3 percentage points in the degree of efficiency of lab cells, significantly increasing the appeal of the CIGS technology. For the future, this means that CIGS thin-film solar modules will not only be more powerful than multicrystalline solar cells, but also more cost-effective to produce. CIGS technology will therefore assume an important role in the next photovoltaic investment cycle.

The record breaking cell was produced in a co-evaporation process, a technology which was further developed and patented by both Manz and ZSW. The excellent reproducibility of the record process suggests good transferability of the technology in systems engineering for mass production. Manz is operating the CIGS innovation line at the Schwäbisch-Hall location to transfer the knowledge from the lab into mass production with the goal of continually increasing the degree of efficiency while simultaneously reducing production costs. Manz's researchers have already achieved notable results: The production costs of CIGS thin-film technology in a CIGS turnkey factory built by Manz (CIGSfab) are, depending on the location and size of the factory, up to 50% lower than the costs of today's still prevalent crystalline silicon solar technology.

As part of ZSW and Manz's collaborative research, which is supported nationally by Germany and regionally by Baden-Wuerttemberg, cost reduction of solar energy will continue to be promoted. The competitiveness of solar power increases steadily through the increase of the efficiency rate and simultaneous decline in cost. In many parts of the world, solar power is now at a similar price level as power from fossil energy sources and considerably below the price of power gained from offshore wind farms.

Dieter Manz explained, "CIGS technology is currently the superior solar technology in every respect and combines the best of about 40 years of German development history funded by the Federal Republic. Together with our strategic partner Shanghai Electric, we will continue to drive the potential in CIGS technology forward and put Manz CIGS*fab* customers in the position to locally manufacture CIGS solar modules with the highest degree of efficiency and lowest production costs. Whoever wishes to invest in photovoltaics today and make money doing so cannot pass up on CIGS technology. The close collaboration between research and industry was a key to success along Germany's path towards playing a leading role in this area. The next step is helping to bring this technology throughout the world. The environment for this is now better than ever. Particularly in large markets with regulations regarding local value creation, CIGS technology can make the most of its unique advantages. Due to the high level of integration, the production process is faster and considerably more affordable than any other solar technologies. The required materials can largely be procured on location. Because CIGS solar plants will make power generation more efficient and affordable worldwide, I am optimistic that CIGS thin-film technology will gain significant market shares. As the only worldwide provider of a fully integrated production line for CIGS thin-film modules, major opportunities for growth are opening up to us, which we want to take advantage of!"

Manz AG – passion for efficiency

As a globally active high-tech equipment manufacturer, Manz AG, based in Reutlingen, Germany, is a pioneer for innovative products in fast-growing markets. Founded in 1987, the company has expertise in seven technology sectors: Automation, laser processing, vacuum coating, screen printing, metrology, wet chemical and roll-to-roll processing. Manz deploys and continuously develops these technologies in three strategic business segments: Electronics, Solar and Energy Storage.

The company is led by founder Dieter Manz and has been listed on the stock exchange in Germany since 2006. It currently develops and produces in Germany, China, Taiwan, Slovakia, Hungary and Italy. It also has sales and service branches in the United States and India. Manz's claim "passion for efficiency" offers the promise of production systems of the highest efficiency and innovation to its customers in dynamic, future-oriented industries. With its comprehensive expertise in developing new production technologies and related

machines, the company contributes substantially to reducing production costs for end products, making them accessible to large groups of buyers the world over.

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