Press Release

TRUMPF Group
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Press/Public Relations

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Lasers for today's solar cells and those of the future

TRUMPF TruMicro Series lasers will increase efficiency while lowering manufacturing costs

Ditzingen/Germany, March 29, 2010 – At a recent workshop titled "Laser in photovoltaics," held by Bayern Photonics e.V. in Nuremberg on March 17, 2010, Christof Siebert of the photovoltaics branch management of TRUMPF Laser- und Systemtechnik, Ditzingen, stated that "by now, lasers have become an indispensable tool in solar cell production." Manufacturers are presently using lasers primarily for edge deletion and structuring of solar cells, also termed “patterning or scribing.” In his presentation "What type of lasers will the photovoltaics industry need in the immediate and distant future," Siebert emphasized that although lasers have had vast success in production facilities of the photovoltaic industry, only a fraction of the potential offered by lasers has been utilized so far. This can be partially ascribed to the fact that maximum cell efficiency can be achieved only with extremely precise and fine surface structuring. Here, the laser comes fully into its own and is significantly more efficient compared to alternative processes, because of increased output and lower production costs.

Lasers for thin-film solar cell processing

The use of light as a tool in the processing of solar cells made of amorphous silicon (a-Si) or cadmium telluride (CdTe) is a firmly established practice. Infrared lasers are generally used for the ablation of transparent, conductive oxide films (TCO).

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"For this application, the TRUMPF TruMicro Series 3000 offers a range of small, compact units with wavelengths of 1064 nm and 532 nm, ideal for P1, P2, and P3 patterning," said Siebert. Thanks to their high pulse-to-pulse stability, the diode-pumped solid-state lasers do not just achieve very good processing results, but they can also be easily integrated into existing systems because of their advanced cooling design.

The patterning of thin-film cells made of $Cu(In,Ga)(S,Se)_2$, also known as CI(G)S, presents a particularly high challenge for the laser process. This is especially true for structuring of molybdenum. For this application, nanosecond lasers are still used. Siebert emphasized that: "Here, picosecond lasers produce far better results. Because of their ultrashort pulses, material can be ablated without significant heating of the marginal zone of the process." This will prevent cracking, melting or exfoliation of the layers. The TRUMPF TruMicro Series 5000 offers a range of appropriate picosecond lasers for this purpose.

Edge deletion: Lasers replace sandblasting

To protect thin-film solar modules against unfavorable environmental influences, especially against moisture, a width of approximately 10 millimeters of the layer system is ablated along the edge and covered with a laminated film. For the most part, the photovoltaic industry presently still uses sandblasting for this purpose. "But using lasers is a far more suitable process," explained Siebert. Because ablation at the rate of 50 cm^2/sec and higher that is achievable with lasers, is not only significantly faster, but is also of better quality. Here, the TruMicro 7050 is the perfect solution for processing large

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formats reliably and safely. Microprocessing lasers produce pulses with a length of 30 nanoseconds with 80 millijoule pulse energy. "The TruMicro 7050 with its short pulses and high pulse energy makes it possible for users to ablate the layer system neatly and highly efficiently without damaging the glass," explained Siebert.

Crystalline solar cells: Lasers reduce the per Watt costs

Additional future laser applications include the selective ablation of passivated layers on crystalline solar cells. Here, lasers with ultrashort pulses and high pulse energies are particularly well-suited, due to the excellent beam quality. Said Siebert: "These conditions can be achieved only by means of laser disk technology at this time." Because of the simple scalability of the laser output, a higher production capacity can be achieved, and the high beam quality in the ultrashort pulses significantly improves solar cell efficiency. In closing, Siebert said: "All this will result in reducing the per Watt costs of solar cell performance significantly in future."

TruMicro 7050
The TRUMPF TruMicro Series presents a range of microprocessing lasers customized for structuring, stripping and cutting applications in solar cell production

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Solarzelle
Edge deletion of a solar cell with a laser.

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About TRUMPF
With sales totaling US $ 2.28 billion (€ 1.66 billion) and about 8,000 employees, the TRUMPF Group ranks among the leading manufacturing companies worldwide. The three following business divisions are combined under the umbrella of a holding company: Machine Tools/Power Tools, Laser Technology/Electronics and Medical Technology. Its core business is machine tools for flexible sheet metal processing for punching and forming, laser processing and bending. In the field of industrial lasers and laser systems, the company is the technological leader in the world market. With about 60 subsidiaries and branch offices, the Group is represented in almost every European country, in North and South America as well as in Asia. Production locations can be found in Germany, Austria, China, Czech Republic, France, Great Britain, Japan, Mexico, Poland, Switzerland and the USA.

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