RAYLASE PRESENTS SUPERSCAN IV-SOLAR – THE HIGH-PERFORMANCE DEFLECTION UNIT FOR NEXT-GENERATION WAFER PRODUCTS.

Products, consulting, services for machine manufacturers and integrators

The development of the solar industry has been very dynamic to date. It began with the discovery of the underlying photovoltaic effect by Alexandre Becquerel in 1839, leading to the construction of the first selenium-based solar cells by Charles Fritts in 1883. Today, the solar market is flourishing and profitable on a global scale.

Germany's decision to phase out nuclear power has even placed solar energy on the political agenda, as part of the endeavour to cover around 80% of energy requirements with renewable energies by 2050.

NO LONGER A MERE CATCHPHRASE, THE "EMERGING SOLAR MARKET" IS NOW A REALITY

Dr. Lee, Key Account Manager at RAYLASE, confirms the trend: "The global demand for ever more efficient photovoltaic solutions has been rising sharply for years. The hunger for energy in large economies like China and India is consistently high with no end in sight – in fact, it is on track to grow even more."

Reliable estimates by the industry portal SolarPower Europe indicate that the demand for solar energy will rise by 20% by the year 2030 in Europe alone, accompanied by the creation of 500,000 new jobs in the solar industry. The European solar market is set to grow to 30 GW by 2022.

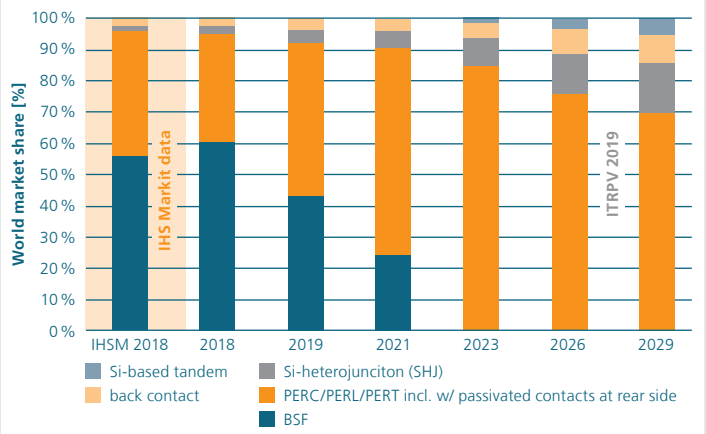
"And it's important to point out that this figure refers ONLY to the estimated demand for solar power within Europe", continues Dr. Lee, who is RAYLASE's expert on the Asian market. "In China, there is already talk of constructing more gigantic solar farms like the Longyuanxia Dam Solar Park, which has 4 million solar panels and the capacity to generate around 850 megawatts of electricity. And this trend is set to continue indefinitely. Due to developments in major industrial countries like India, Japan and the US, global cumulative solar capacity is predicted to triple to 880 GW by 2022. And that doesn't even include China, which will reach a solar capacity of up to 320 GW by 2022."

A closer look at India reveals how much solar market potential already exists in the world's largest democracy. "Solar complexes like the Pavagada Solar Park generate 2,000 megawatts of electricity – enough to supply 700,000 households. That's pretty impressive. But if you consider the total amount of energy required by India's billion-strong population, it's still booming economy and the growing transition to renewable energies across the globe, you begin to have some idea of just how much potential we're talking about here."

HIGHLY EFFICIENT SOLAR CELLS WITH PERC TECHNOLOGY – INNOVATIVE PRODUCTION TECHNIQUES ARE OPENING UP NEW POTENTIAL.

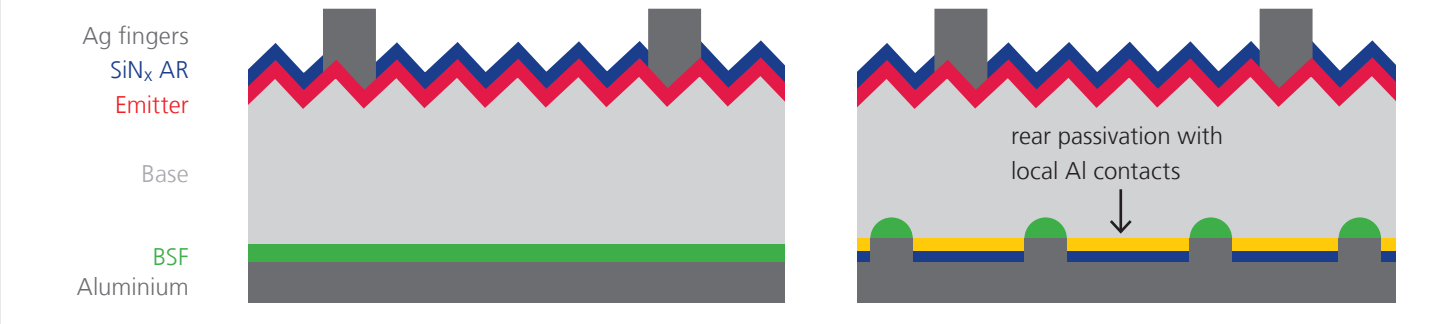
According to Wolfgang Lehmann, Product Manager at RAYLASE: "Solar wafer technology has, of course, been developing steadily for years. And, in particularly dynamic photovoltaic markets like China, solar wafers manufactured using innovative methods like PERC are already being used on a massive scale."

Dr Lee explains: "Wafers manufactured with the PERC method currently offer a conversion efficiency more than 20% higher than that offered by conventional BSF or HIT solar cells. The International Technology Roadmap for Photovoltaics (ITRPV) predicts that PERC solar cells will have a global market share of more than 70% in 2026 – and laser technology plays a crucial role in this production technique."



Source: ITRPV Report 10th Edition

In the PERC production process (Passivated Emitter Rear Contact), greater energy conversion efficiency is enabled by a dielectric passivation layer (usually Al_2O_3, SiO_2, SiN_x). This reduces the recombination of electrons at the rear surface of the solar cell, where the electrons would otherwise experience a strong attraction to the aluminium layer. As a result, more electrons reach the front emitter and the current density is increased.



Source: T. Dullweber et al., Photovoltaics International, vol. 13 (2011), p. 77

The process known as Laser Contact Opening (LCO) represents an important step forward in the manufacturing of PERC cells. It uses laser ablation to create contact openings in the rear passivation layer. The focus is on the selective removal of passivation layers by means of a dash, dot or line pattern.

Wolfgang Lehmann continues: "Typical methods for opening the rear of the cell include mechanical marking or wet-chemical etching. Neither of these methods is feasible in terms of speed or waste production – with wet processes in particular leading to a high degree of contamination. The laser process is therefore ideal for selective, contact-free removal of the layer. However, these new solar technologies also present challenging requirements for the entire solar wafer manufacturing process."

WITH PERC AND SIMILAR TECHNIQUES, DOES GREATER SOLAR WAFER EFFICIENCY COME AT THE PRICE OF HIGHER PRODUCTION COSTS AND MORE EXPENSIVE PRODUCTION SOLUTIONS?

Top speed, extremely dynamic responses and the highest levels of precision in industrial mass production in cutting-edge laser manufacturing – these were the goals in developing the SUPERSCAN IV-SOLAR, which was optimized for applications such as the PERC process.

Dr Lee says: "With the SUPERSCAN IV-SOLAR, RAYLASE can offer machine manufacturers and integrators who want to be active in this market the ideal deflection unit for sustainable solar wafer manufacturing processes such as PERC." "Typical 6-inch wafers require between 100 and 300 laser-written lines, each approx. 155 mm long and usually evenly spaced at intervals of 0.5 m to 2 mm. The target processing rate demanded by the solar industry is over 3,600 wafers per hour or less than 1 second per wafer, for which the high-speed scanner requires a scribing speed in excess of 25 m/s."

According to Wolfgang Lehmann: "These figures demonstrate that the "missing link" in PERC processes is a scanner solution with this capability. With a marking speed of up to 50 m/s, precision in the range of ± 10 µm and extremely dynamic responses thanks to SiC mirrors, the SUPERSCAN IV-SOLAR is currently the most powerful solution available worldwide. These qualities ensure a high rate of production throughput, which leads to lower production costs!"

THIS RAYLASE SOLUTION ENSURES A HIGH THROUGHPUT OF UP TO 3,600 WAFERS PER HOUR WITH CONSISTENTLY HIGH QUALITY.

"The SUPERSCAN IV-SOLAR is very flexible. If one would like to scribe the wafer fast and precise, a so-called Skywriting control function can be activated. With this feature, the scanner does not need to accelerate or decelerate during scribing process thus resulting equidistance pulses at the beginning and end of the line. In addition, the scanner does not need to slow down at the "window" openings in the passivation layer, the scanner jumps over them, therefore avoiding wasting time unnecessarily. We can merge the line segments into a single line so that no deceleration or acceleration occurs at the "windows". In this case, we use the "dashed-line" feature so that the laser is only modulated in the relevant places."

Another advantage is the optimal interplay between the SUPERSCAN IV-SOLAR deflection unit and the SP-ICE-3 control card from RAYLASE. The SP-ICE-3 enables control of two deflection units and therefore has two field transformations that can be used to mark two wafers with an identical layout simultaneously but with different orientations on the carrier.

According to Dr Lee: "Many industries with various application scenarios can benefit from this capability of our RAYLASE solution. Although we developed SUPERSCAN IV-SOLAR for the solar market, the product is not limited to this industry alone. Our solution can be implemented for any application, such as laser material ablation, that requires high speed and a high degree of precision."

SUPERSCAN IV-SOLAR FROM RAYLASE – MAXIMUM PERFORMANCE FOR YOUR NEXT-GENERATION SOLAR SOLUTION

The 2-axis SUPERSCAN IV-SOLAR deflection unit is designed to meet the rigorous performance requirements that apply to high-speed, high-precision laser processing of solar cells because this particular application requires the highest possible positioning speed.

The SUPERSCAN IV-SOLAR's digital control offers maximum speeds of up to 50 m/s final speed. The robust, water-cooled master block design enables applications at up to 2 kW laser power. And, with the SP-ICE-3 control card and the corresponding software from RAYLASE, you are perfectly equipped to control the deflection units via SL2-100 protocol 20 bit or XY2-100 protocol 16 bit.

Of course, machine manufacturers and integrators can choose from a wide range of customization options. Lenses, protective glass, mirror substrates and coatings are available for all standard laser types, wavelengths, light densities, focal lengths and processing areas.

DIGITAL CONTROL

In short, with products like the SUPERSCAN IV-SOLAR, RAYLASE believes it is perfectly positioned to handle innovative applications.

"And, of course, development is constantly evolving", concludes Wolfgang Lehmann. "As we've outlined here, the SUPERSCAN IV-SOLAR is the optimal deflection unit for machines used to manufacture PERC wafers. And we're already thinking one step ahead and testing our deflection units in the LDSE process ("Laser-Doped Selective Emitter"), which is certain to push the boundaries of what can be achieved with solar wafers."

TOGETHER WE CAN MAKE YOUR SOLAR WAFER PRODUCTION SOLUTION WORK – FOR THE MARKETS OF TODAY, TOMORROW AND EVEN BEYOND.

The solar market is continuing to grow and, accordingly, increasing numbers of machine manufacturers and integrators are also becoming involved in this segment and will be able to benefit from our experience.

RAYLASE products have been used in solar and photovoltaic solutions for years. Our first customer was a true pioneer in this segment and only purchased deflection units from us. Today, we partner several companies in this segment – not only supplying them with hardware but also providing them with active support in implementing their solutions. RAYLASE offers a complete portfolio, from cost-effective solutions with the SUPERSCAN IIE, to high-performance solutions with the SUPERSCAN IV. We work closely with customers to help them improve throughput while maintaining precision. RAYLASE has the technology to offer high performance, high speed and flexibility to meet the requirements of industrial PERC cell production.

"Another key benefit of using RAYLASE technology to implement a wafer production solution is that it will be more powerful yet more cost-effective than comparable solutions," explains Dr Lee. "That's because our competitors' products are either analog or fully digital. Analog offers cost savings, but this comes at the expense of performance and competitiveness. A fully digital solution, on the other hand, is still unaffordable for many companies because several machines are required for mass production."

RAYLASE products like the SUPERSCAN IV-SOLAR or the SP-ICE-3 control card can also be used in a semi-digital environment, which enables solutions with an ideal balance between performance and efficiency.

Wolfgang Lehmann sums up as follows: "We learned in the German market around 10 years ago just how important it is to be able to strike this balance. And, with our experience of projects in the solar industry, we can work with machine manufacturers and integrators to develop solutions for tomorrow."

In conclusion, Dr Lee says: "Our desire to bring all of our experience to bear on projects with our partners is also reflected in the company's new claim – THE POWER OF WE. Whether you already have experience in the solar area as a machine manufacturer and integrator or would like your company to enter this promising market, we at RAYLASE are your ideal partner for design, integration, hardware and services relating to laser deflection units."

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