Press Release

Clear efficiency gain in laser production for electromobility

The RAYSPECTOR process monitoring unit has further propelled the evolution of laser material processing towards greater flexibility and quality.

Weßling, 01 October 2021 RAYSPECTOR, the innovative monitoring unit developed for the AS FIBER deflection unit, supports many highly complex laser manufacturing processes with optical tracking – which is often essential for the welding of battery contacts or bipolar plates for fuel cells. RAYSPECTOR enables both visualisation of the workpiece and inspection of melt or weld parameters at all stages of manufacturing. As a result, defects and their precise position on the workpiece can be documented and eliminated. This leads to less scrap overall and to greater sustainability in the manufacturing process. The electromobility sector in particular benefits from innovative, high-performance laser products as it transitions to the large-scale production that today's market demands. These products enable clear efficiency gains based on automated digital laser systems.

The RAYSPECTOR monitoring unit represents another leap forward for laser technology company RAYLASE, making it easier to offer the market profitable, user-friendly solutions for smart manufacturing/Industry 4.0 that serve to promote development of the electromobility sector across the globe. The AS FIBER deflection unit, in combination with RAYSPECTOR, helps companies gain a competitive advantage and position themselves as more sustainable thanks to integrated automated laser system solutions. In all areas of laser material processing, and in the booming electromobility market in particular, three goals are currently critical and will continue to prove critical in future – increase productivity, enhance process stability and improve profitability.

RAYLASE supports these goals and closes a technology gap with these two high-performance products combined. Until now, standard laser manufacturing processes were frequently limited in terms of field size due to F-Theta lenses. The AS FIBER eliminates this restriction and, in combination with the RAYSPECTOR, provides a complete overview of the process, even with very large processing areas. As a result, the flexibility and quality of industrial manufacturing are increased several times over. RAYLASE Product Manager Wolfgang Lehmann explains the innovation: "The RAYSPECTOR is a process monitoring unit that we developed specifically for the AXIALSCAN FIBER deflection unit. The AS FIBER uses various apertures/mirrors with apertures ranging in size from 20mm to 30mm or even 50mm. The advantage here has to do with the conduction of the process light, which is made available by means of the pre-focussed AS FIBER and then guided into the processing sensors in the RAYSPECTOR based on wavelength. The monitoring module splits the process light into long, medium and low wavelengths. Longer wavelengths are used to evaluate thermal radiation, while medium wavelengths are used for camera monitoring and position detection, and low wavelengths (the "plasma glow") allow specific conclusions to be drawn about welding and melting quality. Because the AS FIBER is a pre-focussing deflection unit, it ensures that the process light is available in its unaltered form without any chromatic aberrations. This allows us to work with a high degree of flexibility, even on larger field sizes, and to significantly improve the quality of the process as a whole". This capability is essential in the electromobility sector, with its large number of tricky, high-precision manufacturing steps, and its importance for high-quality production cannot be overestimated. In particular for the welding of battery cell contacts, bus bars and power electronics and for the production of fuel cells, the combination of a deflection unit with suitable imaging is not only extremely useful but also essential for viable, cost-efficient series production.

In this sense, the RAYSPECTOR monitoring module plays a role similar to a Quality Assurance Manager in the laser manufacturing process. Its automatic, dynamic and fast focus tracking with just one camera enables monitoring of melting processes (such as those used in 3D printing) by means of coaxial inline camera recording. In the electromobility sector, it allows the process to be positioned precisely on the workpiece in offline mode, so that the orientation of the part can be accurately determined before each step. The result? Sharp, high-contrast images along the entire processing chain, as well as greater position accuracy. All of which adds up to improved safety. In addition, movement of the camera axis and the pre-focussing deflection unit are automatically coordinated with each other, while the RAYGUIDE Click & Teach software enables full control of the complete laser process. This means, for example, that individual tiles or elements can be joined together for a high-resolution image of the entire field. In parallel, the Process Data Analyzer (PDA) enables the visualization of position data from the process.

Cameras with chip formats up to 2/3 and a C mount are ideal in this context. The real benefit stems from the mechanical interface that complies with the industry standard. As Wolfgang Lehmann explains: “When using the RAYGUIDE Click&Teach software, four different camera modules from two different manufacturers can be used as standard. However, customers can also use their own camera or generate camera images using the driver – without the software features, of course”. The workpiece can be tracked across a large field of view throughout the entire production process. In addition, the process monitoring unit has an optical output for plasma and thermal radiation.

In the area of additive manufacturing (AM), the AS FIBER deflection unit also produces excellent results when monitoring melting in 3D printing. The melting paths of the workpiece can be optically tracked throughout the entire hatching process within a layer by means of connected light intensity sensors or quotient pyrometers for thermal radiation. Defects can be detected in the software and documented using a “defect map”. “Our RAYSPECTOR really comes into play when customers want to develop very challenging workpieces and rely on a high-speed camera for processing”, says Lehmann. Another benefit offered by the monitoring unit is its dust-proof industry design that complies with the IP64 standard – and is also a feature of the AS FIBER. This results in increased process reliability and longer product lifetimes. The complete optical system requires no cleaning or maintenance.

And, finally, the RAYSPECTOR enables easy, user-friendly integration into the existing machine design. The camera tracking can be installed vertically or horizontally based on the location of the AS FIBER collimator. In addition, the camera focussing can be tracked regardless of camera position. Thanks to plug and play capability, users require no expertise to synchronise the monitoring unit with the AS FIBER – everything is fully automated and takes care of itself.

“And that’s just for starters,” continues Wolfgang Lehman. He emphasises the innovative capabilities of RAYLASE as follows: “We believe we have a mission to continually improve our products to best meet the needs of our customers.” Which means that the functional scope of the RAYSPECTOR software will continue to be strategically expanded and improved in future. He also says that “the solutions our company offers ensure much greater usability and optimised laser material processing, even for highly complex and precise processes. Depending on the process monitoring sensor used, the extensive imaging capabilities of the RAYSPECTOR in combination with the AS FIBER can significantly improve the efficiency of the laser process, as upstream or downstream quality inspection steps can be eliminated. This helps reduce downtime and cuts costs”.

In this way, the AS FIBER deflection unit and the RAYSPECTOR monitoring unit are at the cutting edge of what efficient industrial laser production currently has to offer – a high standard of quality with greater output at lower costs.

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About RAYLASE

RAYLASE GmbH is a highly innovative, international laser company based in Wessling near Munich. Founded in 1999, the Bavarian company offers high-precision opto-mechanical components, control cards and software for the rapid deflection and modulation of laser beams for laser material processing in industrial manufacturing. With over 130 employees worldwide, the RAYLASE Group stands for innovative technology of the highest quality. Since 2007, the company has a subsidiary and its own production facility in Shenzhen, China, as well as several international representatives in the US, Italy, Japan, Korea, and Taiwan.

The laser deflection units comprise opto-mechanical scanners and digital control electronics with an intuitive software interface. These form the core of industrial laser systems and enable more flexible, economical, and precise processing of a wide variety of materials such as metal, plastic, paper, textiles and many more. Opto-mechanical deflection units also offer excellent image processing for better calibration, simple automation, and exact monitoring of a range of laser processes.

Customers come from the electronic, automotive, photovoltaic, textile and packaging industries. RAYLASE's current focus markets are electromobility, for example, in battery production, solar wafer production for photovoltaics in the solar industry and additive manufacturing. RAYLASE supports its customers primarily in four core applications: laser cutting, laser welding, laser surface processing and selective laser sintering or welding for additive manufacturing. In each of these areas, the company drives digital innovations by combining these with established technologies.

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