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The art of managing the laser diode environment

Moisture and particulate matter pose a serious challenge to the laser welding of plastic components. The perfect weld can only be achieved if the laser diode used to carry out the process operates optimally in a moisture and particle free environment. The presence of either of these two can shorten the operational life of the laser and increase its operating cost.

With an industry history stretching back more than sixty years in the highly specialized plastics joining business, Branson Ultrasonics Corporation, part of Emerson Industrial Automation and based in Honeoye Falls, New York, was one company that faced this challenge.

The company's Laser Group designs and manufactures a number of industrial laser joining solutions for a global customer base active in the automotive component, printing peripherals and medical device industries amongst others. For them, there is no room for error and the solutions they manufacture for their clients have to meet exacting standards and requirements.

At the forefront of Branson's plastic joining technology is their laser assembly system which uses a process called Simultaneous Through Transmission Infrared welding (STTIr). This allows a laser, housed in a sealed chamber, to pass through one plastic part, the transmissive component, into another which is called the mating or absorptive component. The result is the precise heating and melting of the interface which is then joined together via a clamp that is preprogrammed to use the exact amount of pressure. This process produces a continuous hermetic seal throughout the entire joined interface.

Another technique is called Wide Beam Scan welding which is used to join large surface areas. Two parts are clamped together and traversed through a curtain of laser light that is projected down onto them, producing the weld.

"Controlling the environment in the sealed chamber that houses the laser diode in all our laser welding methods was a challenge for us," said Paul Rooney, marketing product manager, laser technology at Branson. "Whatever the solution that was going to be formulated needed to eliminate moisture by absorbing any built up during the operation of the laser, but also could not generate any particulate. The chamber environment had to be moisture and particle free."

Branson could have attempted to manufacture its own solution. The challenge was that the barriers-to-entry were high as they would have had to absorb all the research and development costs and face the ultimate risk – their solution may not have worked.

Knowing the importance of ensuring a perfect weld every-time and wanting to reduce the margin of error, Branson called in Multisorb Technologies (Multisorb), a Buffalo, New York, company and long time business partner. Multisorb specializes in the creation of tailor made sorbent solutions for global clients active in a wide array of industries including the healthcare, food and beverage, electronics and transport, storage and government sectors.

“Before we could create a solution that would address Branson’s requirement, we had to understand the product, its operational environment, and what is required of it on the production line, to ensure optimal functioning,” says Sam Incorvia, senior product leader in Multisorb’s electronics and filtration division.

Multisorb’s product specialists and Branson’s product engineers collaborated and worked side-by-side. This integrated team approach allowed Multisorb to use its Calculations through Operations (CtO) value added service methodology. Through this unique process Multisorb was able to consult back to the client and advise them what they needed and design a sorbent solution that would solve the problem.

It was imperative that the solution employed did not contain residual dust and would not generate any particulates that could contaminate the optics used in the laser device. Conventional sorbent solutions are by nature typically “dirty” meaning that they have the potential to generate fine particulate material during handling and operation of applications, especially when subjected to shock and vibration. In addition, dust particles could not dislodge during vibration and whatever solution was formulated had to be easily mounted above the diode in a very limited space. It also had to be “clean” meaning that under various temperature swings during use, the material would not give off any volatile gasses and moisture that could coat the optics and negatively affect the performance of the laser.

“Although the laser environment was a completely new ball game for us we worked very fast. It took us between four and five weeks to create the solution for Branson from scratch. We formulated a sorbent solution designed to manage moisture by providing a non-condensing atmosphere based on our PolySorb™ technology. It was loaded into resin, injection molded into a structured component using a single cavity mould that shaped it perfectly to fit into the sealed chamber housing the diode. The process was seamless,” adds Incorvia.

The benefits to Branson were noticeable almost immediately. The risk of moisture and particles were removed, the operational life of the laser diodes enhanced and premature failures drastically reduced.

“This has been a major enhancement to our great value proposition for customers,” adds Rooney. “We have very satisfied customers globally because the product we now sell lasts longer and is more robust. This means we have less post-sale issues to deal with. Our customers can pass the benefit down their supply and value chain by delivering products and solutions that meet very strict quality control checks on time and first time round.

Both Branson and Multisorb will continue to work together to develop specialized products and unique solutions.

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About Branson

Headquartered in Danbury, Connecticut, Branson Ultrasonics Corporation is the leading worldwide manufacturer of plastics joining equipment including ultrasonic, linear and orbital vibration welders, hot plate welders, laser IRAM welders, infrared welders, thermal welders and spin welders for assembling thermoplastics. Branson also manufactures equipment for metal welding, processing biological and chemical solutions, and precision commercial and industrial cleaning. Branson was founded in 1946 and is a subsidiary of Emerson, St. Louis, MO, as part of the Industrial Automation Division. For more information, visit www.BransonUltrasonics.com

About Multisorb Technologies

Multisorb Technologies has been an innovator in active packaging technology for over 45 years. Founded in 1961 by John S. Cullen to protect products against the damaging effects of moisture, today Multisorb is the world leader in the development and production of active packaging components.

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