

ATHANASSIOS KALIUDIS

Emission-free Electrobusses in London

More and more cities around the globe are opting for electric buses made by BYD. One of the strengths of this Chinese company is its in-house expertise in high-performance batteries. Laser technology is used to weld their highly sensitive components.

It looks like any of the other thousands of red double-decker buses plowing through the loud traffic on London's streets, but if you listen closely you'll soon realize that this number-16 bus is different. Instead of the usual engine rumbling all you can hear is a high-pitched hum. Indeed, it is the world's first double-decker bus designed to run on electricity. It is part of a plan to improve air quality in the English capital. More and more cities around the globe share London's dream of zero-emissions local transportation and are switching to environment-friendly electric buses.

Chinese company BYD has taken advantage of this trend, and is driving it forward. The three letters making up the company's name are indicative of its great ambitions – they stand for "Build your dreams." In 2015, BYD sold 7,500 electric buses to cities around the globe; more than any other manufacturer. No less than 160 municipalities in 40 countries have run trials of the different variants of BYD's electric bus, including New York, Tel Aviv, Montevideo, Kuala Lumpur and now London. Electromobility is the way forward to a greener future. Electric motors do not produce any harmful CO2 emissions and are much more efficient than internal combustion engines: a gasoline-powered vehicle converts only 19 percent of the energy it consumes into motion, whereas electric vehicles have a conversion efficiency of 64 percent.

About the manufacturer

Created in 1995, BYD is a Chinese companyin the southeastern Chinese city of Shenzhen. The three letters of its name stand for "Build your dreams." From its origins as a small battery factory with 20 employees, it has grown into a large, international group employing 180,000 people. As well as manufacturing cars and buses, the group also makes rechargeable batteries and solar cells.

About the electric bus

BYD Auto delivered its first electric bus in 2010. Today the company manufactures seven variants at four production sites. The core component of these vehicles is the in-house-developed iron phosphate battery, which gives the buses a range of 250 kilometers and can be recharged in around four hours.

The laser machine

BYD has installed a total of 120 TRUMPF laser machines in its battery plant: 70 from theTruDisk series and 50 from theTruPulse series. Laser technology is the best method to weld highly sensitive components.

Thousands of kilometers away, in the southeast Chinese city of Huizhou, Liu Huaping, BYD's process department manager, shows visitors around the plant where BYD manufactures the batteries for its electric buses – one of three such sites. "The batteries are the core components of our vehicles; they determine how far the buses can travel. They have to be able to store as much energy as possible without being too bulky or heavy," says Huaping.

When designing electric vehicles, the biggest challenge is the storage battery, not the engine.One of the reasons for BYD's unparalleled success as a manufacturer of electric buses is that the company was able to build on its reputation in the battery industry. BYD began producing rechargeable batteries in 1995, but didn't turn its full attention to the automotive industry until 2003. Almost every single component is manufactured by BYD in-house: from the electric motor to the steering wheel and the fenders. The company grew rapidly and soon joined the ranks of China's largest carmakers.

Buses were finally added to its portfolio in 2009. BYD developed its own iron phosphate battery for these vehicles. Iron phosphate batteries are safer than the more common lithium-ion batteries because they are not susceptible to the thermal runaway phenomenon, which can cause the latter to catch fire or explode. The batteries developed by BYD are also kinder to the environment because they are recyclable and don't contain any heavy metals.

Efficient and reliable production processes are the key to meeting the growing demand for these energy-storage devices, while ensuring quick delivery and affordable prices. "Welding plays a significant role in the battery manufacturing process. Among other things, it is used to attach the connectors and to seal the battery enclosure," explains Huaoping.



Since 2013 BYD´s electric buses like this one drive on London´s streets. In October 2015 the world´s first electric doubledecker bus entered Service. (Images: BYD)



BYD developed its own iron phosphate battery for the electric busses. They are safer than the more common lithium-ion batteries. (Images: BYD)



The first electric double-decker bus designed and built by BYD at its presentation in London. (Images: BYD)

BYD uses different techniques depending on their suitability for a particular type of welding job. They include resistance welding, ultrasonic welding and electron-beam welding. "But laser welding is our method of choice for applications requiring a high degree of precision," says Huaping.

A total of 120 coordinated laser welding Machines

A glance at the factory's fleet of machines shows how important lasers are in the company's manufacturing processes. BYD has installed a total of 120 TRUMPF laser machines in its battery plant: 70 from the TruDisk series and 50 from the TruPulse series. Huaping illustrates this point by fanning out three thin strips of metal: "The majority of our welding operations involve part thicknesses of no more than two millimeters or even less. These parts are made of copper, aluminum or an aluminum alloy." So as not to damage the sensitive battery components, the welding process must have the least possible impact on the surrounding material. "Fine weld seams, low heat diffusion, low intrinsic stress and minimal distortion are our key requirements for such processes," says Huaping as he walks toward a TruDisk laser machine.
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Liu Huaping, Manager of Process Department, Huizhou BYD Battery Co., Ltd.

Disk lasers are ideally suited for welding highly reflective materials such as copper or aluminum. The connections between each battery cell and the next are welded this way. "By adjusting the focus of the laser beam, we can rapidly move from one weld point to the next. We can also adapt the working angle to avoid damage to the optics," explains Huaping, who is meanwhile walking toward a TruPulse system. "We use pulsed lasers to seal our battery enclosures because the weld seams have to be absolutely gas-tight. This process must not generate too much heat because this could damage the internal components of the battery." The chosen method fits the bill because it allows time for the material to cool down between successive laser pulses.

Meanwhile back in London, it's time for our number-16 double-decker bus to return to the depot and recharge its batteries after 250 kilometers on the road. A fully charged battery can easily cover this distance, and the bus will be ready to go again after it has been plugged in for four hours. It won't be the last electric bus operating in the city: London Transport plans to integrate 300 electric buses into its fleet by 2020.



ATHANASSIOS KALIUDIS
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