

Laser Processing on Power Batteries



Introduction

The demand for power batteries is growing fast with the rapid development of new energy vehicles. The shape of the electric battery cells is divided into square, cylindrical and soft pack cells. The shell material is mainly aluminium and stainless steel, of which rectangular and aluminium are the primary materials.



Fig 1. The Electric Battery Cells

Operation principle and application

1. Laser cutting on polar ear

There are four types battery materials: 1) NiMH batteries, 2) fuel battery, 3) lead-acid batteries, 4) lithium electronic batteries.

The production of lithium batteries is a "roll-to-roll" process, whether it is lithium iron phosphate, sodium ion, or ternary batteries, all need to go through the process from thin film to individual battery, and then mounted into a battery system. The lithium battery production process includes: electrode production, battery cell assembly, and packaging.

Lithium batteries are mainly composed of positive electrodes, negative electrodes, diaphragms, electrolytes and battery casings. laser is used to cut and form of positive and negative electrodes.

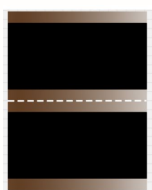


Fig 2. Polar Ear Slitting

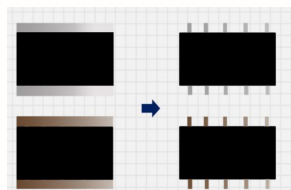


Fig 3. Pole Ear Cutting and Forming

Laser used	1064nm MOPA 250W
Beam expander	1.5x or 2x
Scanner aperture	14mm
Scan lens	F120 and F160
Scan area	50x50mm

Scan lens P/N	Wavelength	FL	Scan area	Aperture	WD	Spot size
TSL-1064-70-163Q-D14	1064nm	163mm	70x70mm	14mm	224mm	22.3-22.6um
TSL-1064-60-160Q-D14	1064nm	163mm	60x60mm	14mm	164mm	22.6-23.4um
TSL-1064-52-120Q-D14	1064nm	120mm	52x52mm	14mm	166.8mm	17.3-19.6um
TSL-1064-35-110Q-D14	1064nm	110mm	35x35mm	14mm	145mm	15.3-16.0um

Table 1. Scan Lens for Laser Cutting Polar Ear of Power Battery

2. Laser cleaning on foil

The positive and negative electrodes of lithium batteries are made by coating with aluminum and copper foil, The foil needs to be cleaned before coating to obtain a completely clean and oxide free surface.

Scan lens P/N	Wavelength	EFL	Scan field	Aperture	WD	Spot size
TSL-1064-85-167Q-D20	1064nm	167mm	85x85mm	20mm	226.3mm	16.0-36.0um
SL-1064-215-340Q-D15	1064nm	340mm	215x215mm	15mm	204.8mm	43.8-49.7um
SL-1064-175-254Q-D10	1064nm	254mm	175x175mm	10mm	304.0mm	51.6-55.3um
SL-1064-170-255Q-D20	1064nm	255mm	170x170mm	20mm	319.4mm	29.4-50.8um

Table 2. Scan Lens for Laser Cleaning on Power Battery

3. Laser welding on power battery

Laser welding process on power batteries includes welding, leak detection, short circuit detection and coding and marking. Different Pulsed laser will be used for welding according to battery material, thickness, and shape.

Scan welding system consists of collimator, scanner, scan lens, objective lens, CCD, dichroic mirror, connecting plate and air knife etc.

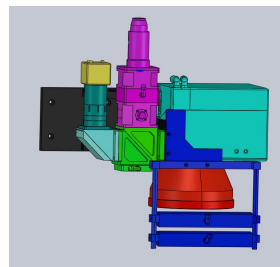


Fig 4. Scan Welding System

Collimator P/N	Wavelength	EFL	NA
COL-1064-D30-F75Q-0.12-WC-V2	1064nm	75mm	0.12
COL-1064-D30-F100-0.1-WC-V2	1064nm	100mm	0.1
COL-1064-D30-F125-0.1-WC-V2	1064nm	125mm	0.1
COL-1064-D46-F150Q-0.1-WC-V2	1064nm	150mm	0.1
COL-1064-D40-F120-0.125-WC-HP3	1064nm	120mm	0.125
COL-1064-D40-F140-0.11-WC-HP3	1064nm	140mm	0.11

Table 3. Collimator for Scan Welding System

Scan lens P/N	FL	Scan area	Aperture	WD	Spot size
SL-1064-120-254Q-D30-WC	254mm	120X120mm	30mm	311.6mm	16.6-59.4um
SL-1064-180-348Q-D30-WC	348mm	180X180mm	30mm	438.0mm	25.4-64.4um
SL-1064-180-400Q-D30-WC	400mm	180X180mm	30mm	504.5mm	25.9-27.4um
SL-1064-250-500Q-D30-WC	500mm	250X250mm	30mm	608.5mm	33.4-54.6um

Table 4. Scan Lens 2kw-6kw Scan Welding System

Conclusion

As a global enterprise, leading photonics innovation since 2011, WOE has built up customization engineering capability for precision laser optics. For more detailed selection of laser optics/laser processing modules, please refer to WOE website or catalogue.

Customization is welcomed.