ALBATROSS

Advanced Light-weight BATteRy systems Optimized for fast charging, Safety, and Second-life applications

MARCH

Contents

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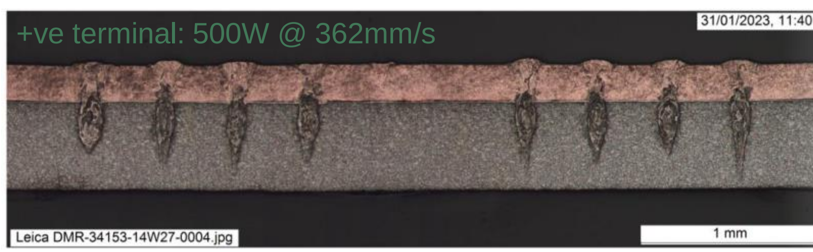
WP2 - Battery Modules and Packaging

Based on the design steps a series of prototypes was developed for different purposes. The prototypes and the tests done on them are described in this newsletter.

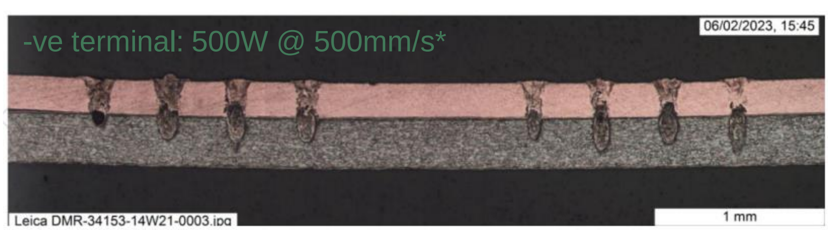
For the module prototyping, the partner TWI has completed its welding trials on flat coupons. The most recent trials have moved on to making busbar-to-empty cell joints. These trials have concentrated on determining the suitable parameter sets to weld a 0.3mm-thickness Ni-plated busbar to either the positive or negative terminal of a cell. Several hundred trials have been carried out.

The equipment and parameters reported in a previous newsletter have been used as the starting point in these trials (laser used at focus, 500W laser beam power, 500mm/s scan speed, with a scan pattern comprising a 4mm diameter 'in-to-out' spiral with a total of 5 revolutions).

As it was found in previous trials on flat coupons, the penetration depth into the cell terminal can be most easily controlled by adjusting the scan speed. The parameters to join the busbars to the positive and negative cell terminals are summarised in Figure 1.



(a)



(b)

Figure 1. Welding parameters developed on empty cells for busbar-positive terminal and busbar-negative terminal joints.

*The metallographic section shown was the level of weld penetration achieved at 350mm/s. As this remains close to penetrating through the underside of the terminal, a slight speed increase to 362mm/s was then carried out.

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WP2 - Battery Modules and Packaging

These trials also examined the tolerance to stand-off distance (i.e. laser focus position), given that it may be difficult to maintain the process within a tight tolerance, when the ALBATROSS moves to the phase of producing many hundreds of welded connections in the modules themselves (e.g., if stack-up tolerances in the build are outside what the tolerance of the welding parameters can still produce a satisfactory weld within).

Two series of welds (one on +ve terminals, one on –ve terminals) were carried out, over a typically +/- 2.5mm range of stand-off distance either side of the focal plane of the laser system used.

These trials found that with the nominal focus position being at a stand-off distance from 264 mm from the datum marked on the scanner, the z-tolerance of the welding parameters was -0.75 mm / +1.5mm, for both terminals. Thus, with a change to a nominal working height of 264.4mm (i.e., working at a position +0.4mm above focus) that tolerance could then be expressed as +/- 1.1mm).

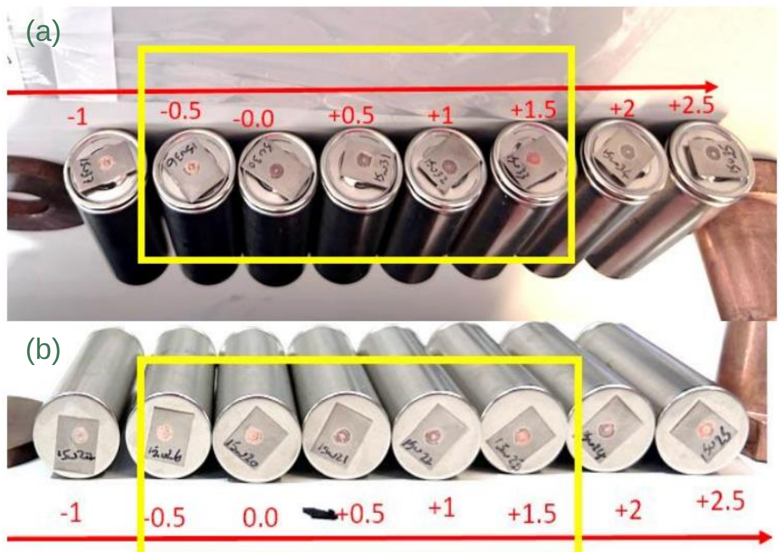

Figure 2. Welds made at different stand-off heights on to both (a) +ve and (b) –ve terminals, with the zero-reference height being 264mm off from the welding head's datum.

Figure 2 shows the welds achieved within this range for both terminals. These parameters, and these stand-off tolerances are now being used as the starting point for welding trials on sub-sized dummy modules. One example of such a sub-sized module prior to welding is shown in Figure 3.

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WP2 - Battery Modules and Packaging

Figure 3. A dummy 6s6p 'mini-module', comprising 3D printed plastic cell holders (from the partner Cleantron), discharged cells (also supplied via Cleantron) and, in the example shown, DLIP textured Cu busbars (from the partner Fraunhofer IWS).

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