Battery Welding Modules Case Study

Carrs weld numerous parts for the car industry from clutch plates to collapsible steering column assemblies. Advances in laser welding technologies are constantly expanding the range of processes which can be performed. Now Carrs can offer many processes which were simply impossible with conventional welding methods.

Below are a range of examples of our previous work in the automotive field.

The Overview

The industrial demand for electric battery modules used in the automotive industry is increasing with the recent advances in the field of regenerative energy sources.

Thermally sensitive applications (Like Lithium-ion cells) benefit from laser welding as there is a strong need for controlled weld depths. The lasers used for this case study were pulsed solid-state (Nd:YAG) lasers with a wavelength of 1064nm. These lasers are known for their flexibility, consistent power output and accurate pulse-to-pulse stability, making them ideal for the welding of the battery modules described in this case study. Carrs Welding Technologies (CWT) has been working through the challenges that are involved for the last 10 years.

The Context and Challenge

Project background and description

CWT's knowledge in welding batteries led a well-known automotive manufacturer to approach CWT for a solution to repeatably weld battery packs for their super car. The objective was to weld enough battery packs for 375 vehicles, which meant 2250 battery modules with 54 cells each.

The Problem

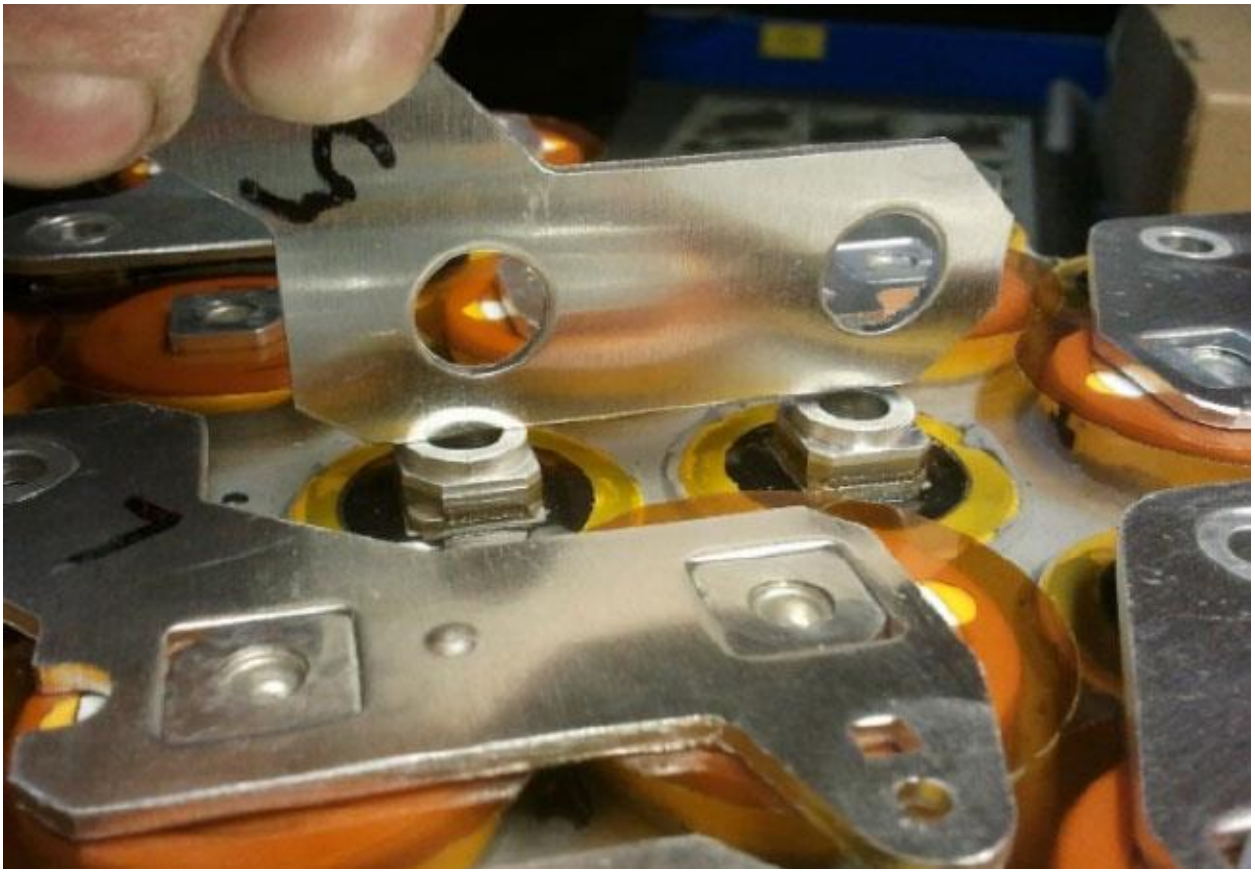
The first problem, CWT faced was the dissimilar materials in play. The A123 Lithium Cells (APR18650 Cylindrical Cell; non-descriptive steel) had to be laser welded to aluminium interconnects (AA3003). This meant that CWT had to find a solution for repeatedly joining two materials with different fusion points, reflectivity, conductivity and viscosity.

CWT also faced another problem related to logistics and health and safety issues surrounding the welding and handling of "live" battery packs.

Project Goals and Objectives

The initial objective was to find a way to successfully weld a cell to an interconnect without losing the weld strength due to inclusions, mainly oxides or silicate.

Pulsed laser welded interconnects



Interconnect assembly

The Process and Insight

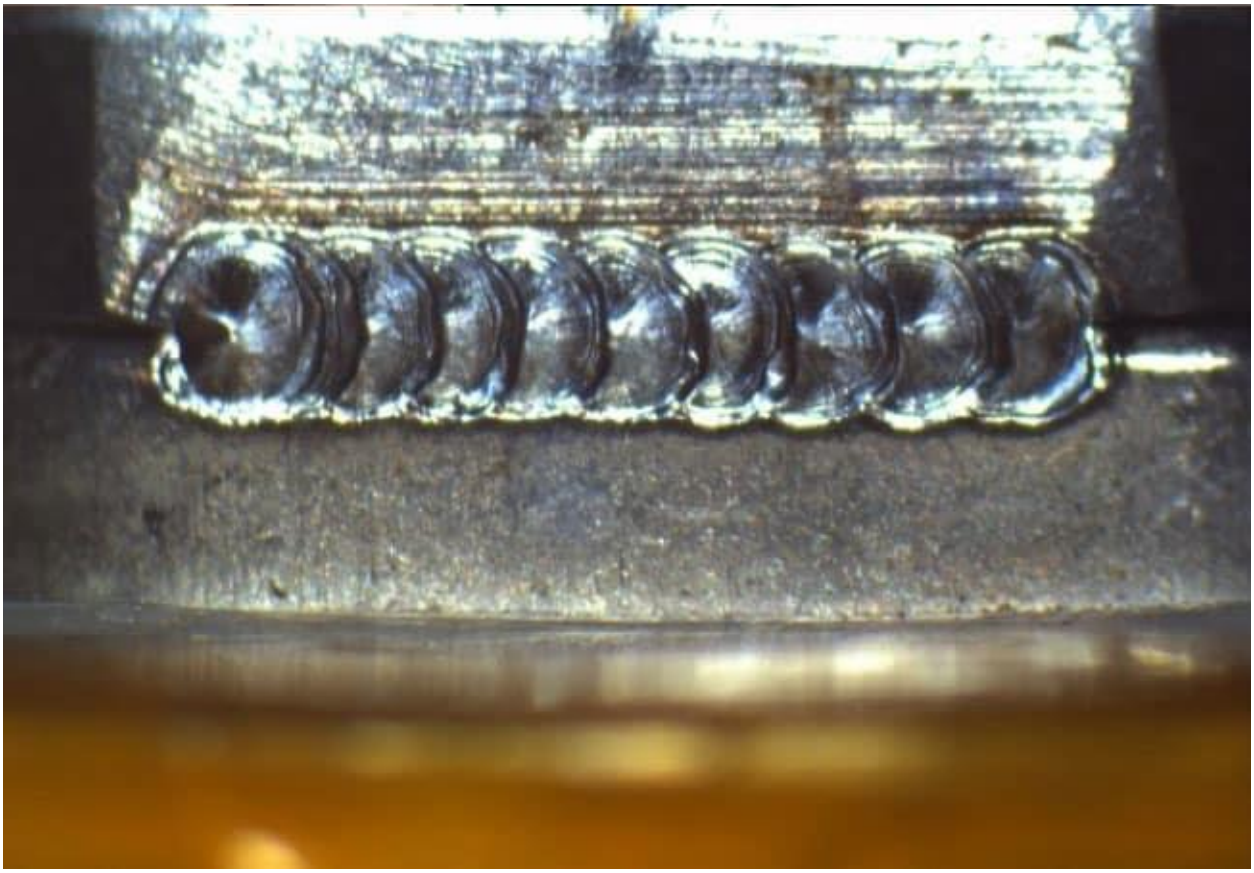
Maintaining the weld strength to resist vibrations was paramount to the success of the project. After a few unsuccessful trials, CWT proposed that a slug made of non-descriptive steel and aluminium (AA1050) could be used as a bridge between the cell and the interconnect.

Several successful trials were conducted which led CWT to set up a production line within their own facility. The next step was to ensure that it was safe for the workforce to work around the modules. Several safety measures were then designed to not only facilitate the handling of the modules, but also the welding and inspection operations.

The Solution

The slugs, previously friction welded before coming to CWT, were then laser pulsed welded to the A123 Cells which gave CWT the perfect material combination for welding the cells to the interconnects. It was the solution both CWT and the automotive manufacturer needed for this battery project.

By assessing the different risks involved in the project and by allocating its resources in key areas, CWT was able to manufacture 18 battery modules (1944 welds) daily and fulfil the production requirements defined by the automotive manufacturer.



Detail of slug to cell pulsed laser weld

The Result

CWT fulfilled the customer's requirements by welding 486,000 cells to slugs and 243,000 cells to interconnects joints and, therefore, completing 2250 modules whilst achieving 100% of the client's delivery schedule, (ie 100% delivery KPI's). This project created an opportunity for an update to CWT's infrastructure which resulted in three new lasers and CWT's progression into new fields of joining, like the "oscillating laser welding".