



Industrial Member Report Summary – Key Findings for Industry

An initial Investigation of Microwelding of Multiple Overlapped Foils using Continuous-wave Lasers

TWI Core Research Programme

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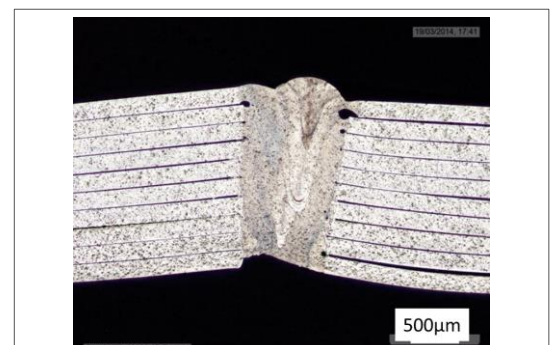
Industrial need

Miniaturisation in the electronics industry requires more and more fusion welding approaches for electrical interconnections (for foils of thicknesses less than 100 μ m). When laser processing copper (Cu) and aluminium (Al), one main challenge is their low infrared absorption at room temperature, which results to a highly sensitive process, affecting the weld quality. Therefore, there is an increased industrial need to maximise confidence in micro-laser welding high reflective metals. This work was carried out with an automotive application in mind: electrical connections in car batteries. Related applications include aerospace, renewable-energy, sensors, medical and micro-electronics industry sectors.

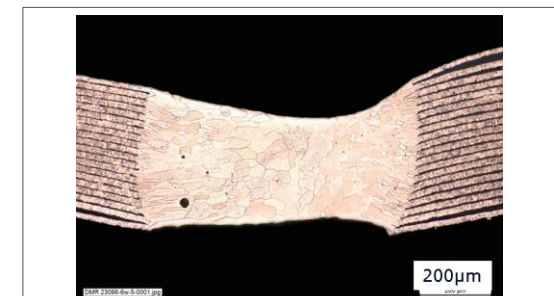
Key Findings

This investigation has introduced a reproducible procedure for assisting industry in equipment and process selection for laser welding of Al and Cu alloy foils, using a 1 micron wavelength laser source. The main conclusions of the trials carried out for this work on multiple overlapped Al and Cu foils are:

- A reproducible welding procedure for laser welding of Al and Cu alloy foils was developed successfully for up ten multiple overlapped Al 1050 layers, each 100 μ m thickness, and for high purity Cu foils, of either 17 μ m thickness each (up to either 20 or 30 multiple overlapped layers) or 100 μ m thickness (up to 4 multiple overlapped layers).
- Surface defects, such as blow-holes and melt ejections, could be controlled in a reproducible manner and this, along with the weld widths achieved, makes the welding conditions identified of interest for industrial applications.
- The CW single mode Yb-fibre laser, in combination with a scanning beam delivery technology and an optimised clamping fixture, allowed transverse welding speeds up to 650mm/min for Al 1050 (100 μ m thickness), and up to of 560mm/min high purity Cu (both 20 and 100 μ m thickness). These speeds could be significant in terms of productivity.



Single-pass ten lap-welded Al 1050 foils, each of 100 μ m thickness (electrical connection applications).



Single-pass 20 lap-welded copper foils, each of 17 μ m thickness (electrical connection applications).

How to benefit from this work:

- As an Industrial Member of TWI, you have free access to the [full report](#)
- If you are not an Industrial Member of TWI, find out how your company could benefit from Membership www.twi.co.uk/membership
- Read more <http://www.qcoala.eu/links/ICALEO-2013-Laser-Processing-of-Copper-and-Aluminium-Thin-Sheets-with-Green-and-Infrared-Pulsed-Laser-Beam-Sources.pdf>
- Contact paola.debono@twi.co.uk to learn more