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# 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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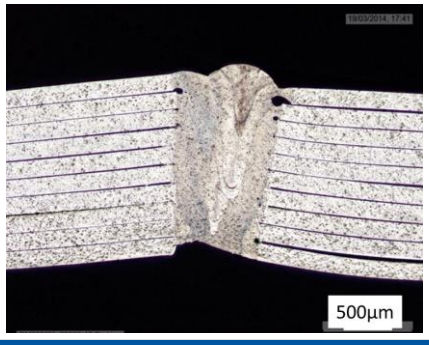
## Industrial need

Miniaturisation in the electronics industry requires more and more fusion welding approaches for electrical interconnections (for foils of thicknesses less than 100µm). 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.

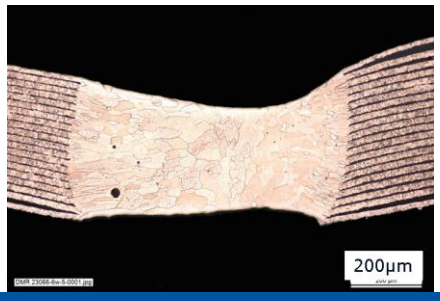
## Key Findings

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 100µm thickness, and for high purity Cu foils, of either 17µm thickness each (up to either 20 or 30 multiple overlapped layers) or 100µm 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 (100µm thickness), and up to of 560mm/min high purity Cu (both 20 and 100µm thickness). These speeds could be significant in terms of productivity.




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




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

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