



CARR'S AND HIGH-
POWER LASER
WELDING, battery
interconnections and
busbar systems.

Phil Carr

Carr's Welding Technologies Ltd

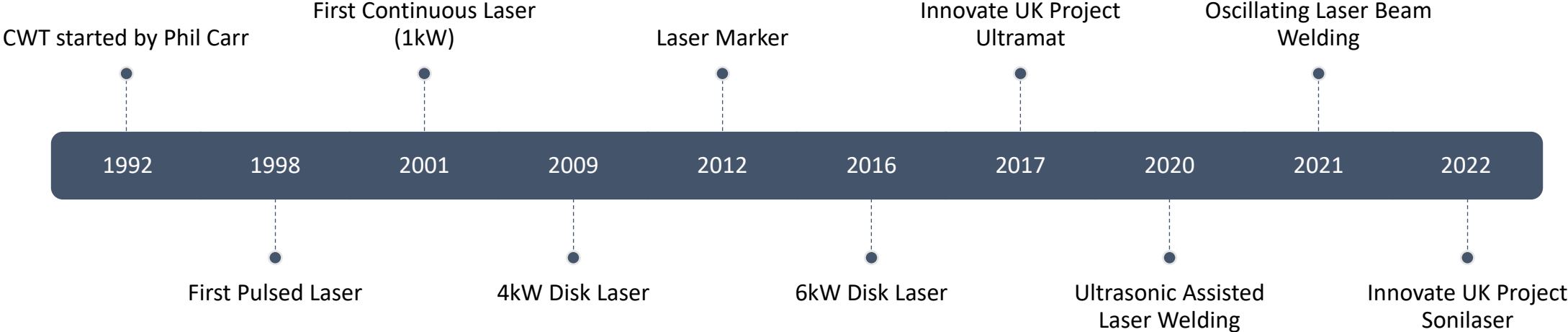
pc@carrswelding.co.uk

<https://carrswelding.co.uk/>

Summary

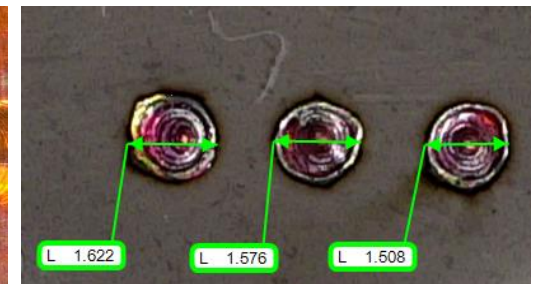
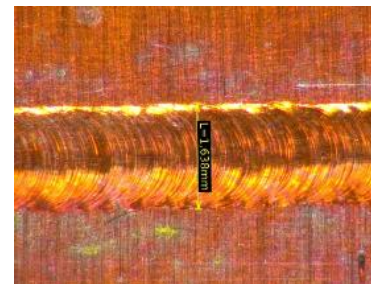
- Company History into laser welding
- Copper and aluminium interconnections in battery applications.
- Oscillating laser beam welding
- Typical examples interconnections
- Future developments of the nonferrous battery interconnects
- Soni-Laser project

Company History



Copper Welding and its Difficulties

Characteristics	Causes
Highly reflective especially for infrared lasers.	Inability to couple the laser beam without high power densities.
Copper's high thermal conductivity.	High heat transfer during weld means it will be harder to fuse materials together.
Ability to absorb heat increases with temperature.	Increases the chances of blowholes and spatter.
Low viscosity.	Highly sensitive to rippling.



Current Limitations in Copper Welding

- Copper's absorptivity increases with the decrease of the laser wavelength which gives visible band lasers an advantage. However, these still don't have the sufficient power for deeper welds.
- Initial high-power requirements can be detrimental to lower thicknesses (e.g. cell terminals to busbars).
- Exceptional thermal conductivity must be controlled when near heat sensitive components.
- Internal reflections on the walls of the keyhole increase weld depths (mainly on infrared lasers)

Oscillating Laser Beam Welding

Enhanced Weld Quality & Consistency

Superior quality when compared to conventional laser welding.

Greater Tolerance for Process Variables

Allows for wider process parameters such as gaps.

Improved Welding of Dissimilar Materials

Wobble parameters allow for better control of the melting and solidification which improves weldability.

Welding Materials Prone to Cracking/Porosity

Delayed solidification and re-melting minimise stress build up which reduces the cracking phenomenon from occurring.



Wobble Modes

In addition to the wobble modes, both wobble frequency and amplitude can be adjusted for process optimization

CW/CCW CIRCLE



LINEAR



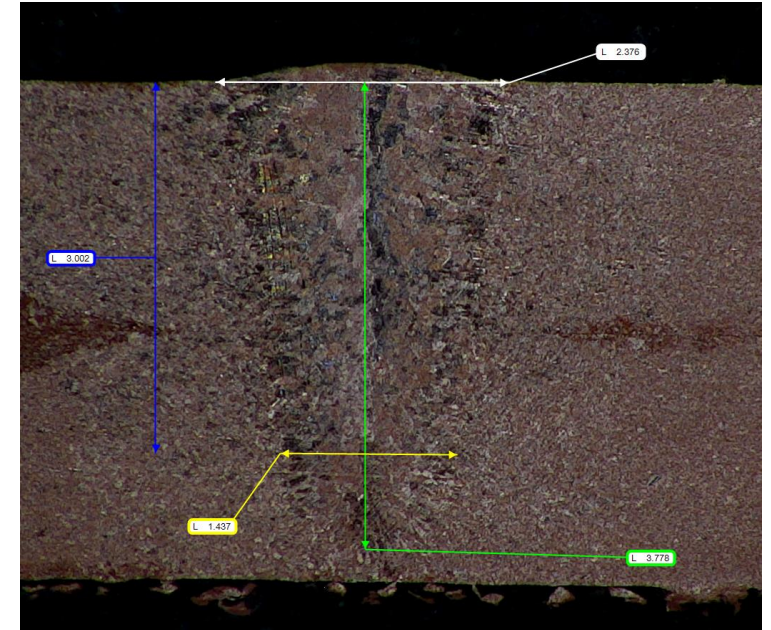
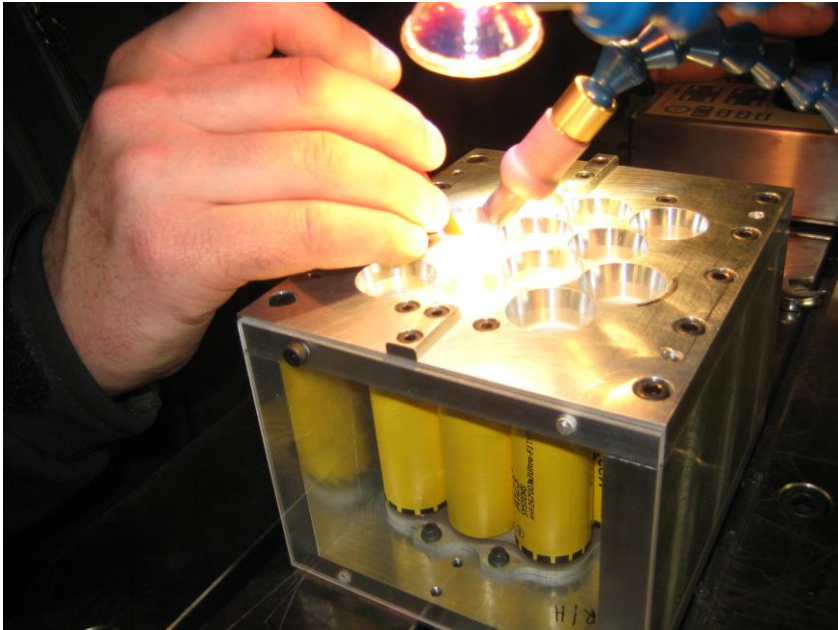
EIGHT



INFINITY



*Special thanks to IPG Photonics for image



Examples of laser welds
in module interconnects.

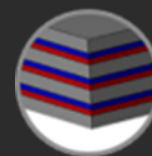
Thank You For Listening



Phil Carr

pc@carrswelding.co.uk

<https://carrswelding.co.uk>



UltraMAT
Ultramaterial Innovations