Welding

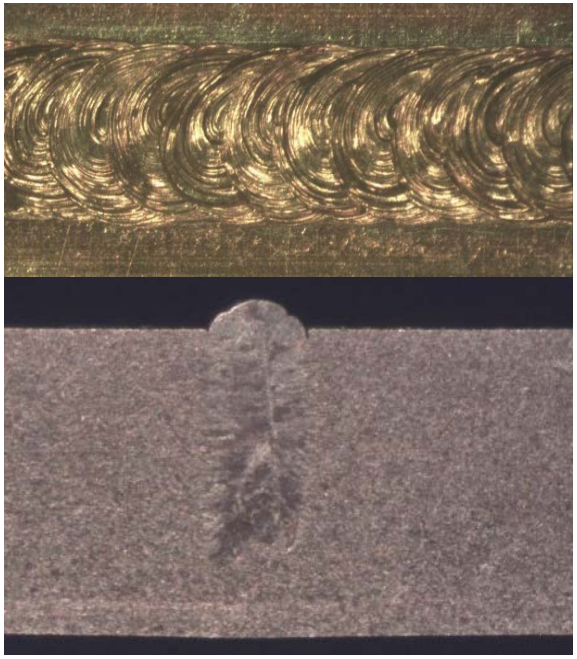
Wobble Welding Copper

Laser welding provides an efficient and stable process due to its high precision and fast production rate which has many applications in the electronics and automotive industry.

Traditionally, laser welding is done with a fixed welding head with a higher power laser having lower beam quality to give acceptable weld widths as single mode beams are too sharp leading to very narrow weld profiles. In contrast wobble welding (or oscillation welding) is where a high beam quality laser is used with a galvo scan-head to rapidly oscillate the focal spot. This method of welding enables much easier control of weld parameters such as weld width and depth of penetration which can lead to a more efficient welding process.

Conventionally, welding copper is seen to be challenging due to the high optical reflectivity and thermal conductivity. This can result in an unstable weld which is prone to spatter formation. The high reflectivity means the material does not absorb a high proportion of the laser beam which can lead to high levels of back-reflection, potentially causing damage to the beam delivery system and instability with the laser. These issues can be reduced by using the wobble welding technique.

A copper-copper lap weld was made using a 2kW single mode (SM) redPOWER QUBE fiber laser, using Argon as a shield gas. The beam was delivered to the work-piece using a standard galvo quality laser. The beam was rapidly moved in a circular motion whilst moving along the weld path, thus producing a weld of the desired width. The top plate thickness was 1.5mm which was joined to a 2.5mm thick lower plate. A linear welding speed of 60mm/s was achieved with a strong joint having no spatter. Similarly, a 0.3mm copper sheet was lap welded onto a 2.5mm lower plate and a welding speed of 200mm/s was obtained. This is a good result as travelling at such speeds using conventional, fixed head welding at this power level produces a lot of spatter.



Application Parameters

Type	redPOWER QUBE 300W – 2kW
Power	2kW
M^2	1.1
Focus beam diameter	33µm ($1/e^2$)
Linear Weld Speed	60mm/s at 1.5mm thickness / 200mm/s at 0.3mm thickness
Modulation	None