

Welding

Hairpin Welding in Electric Motors

The boom in e-mobility is generating demand for electric motors which are manufactured with solid copper hairpins (wires) in the stator which generate a magnetic field that creates the motion. These copper wires need to be subsequently welded. These wires are typically lacquered or coated with an organic layer to give them electrical isolation. This layer needs to be removed from the welding zone prior to joining – this can be done by one of our ns pulsed fiber lasers. These wires can take many forms, from small round wire < 3mm to square sections that can be up to 6mm in width.

The challenge is to produce a high quality bond with minimized heat input and with minimal spatter. Excessive heating can lead to unwanted burning of the electrically isolating coating and spatter can cause unwanted deposits on the stator with the risk of electrical shorts in the assembly.

Our redPOWER 2kW QUBE single mode fiber lasers are ideally suited to this task and are able to effectively join the copper wires with low heat input and minimal spatter. Using a scanner based optical delivery system the small spot size generated by the high beam quality is moved rapidly in a spiraling motion using very high linear speeds. This technique helps to control the weld pool and its stability giving rise to deep penetration, low heat input welds with minimal spatter. The spiraling technique gives a lot of flexibility in tailoring the joint for the shape and size of the wires to be joined.

Application Parameters

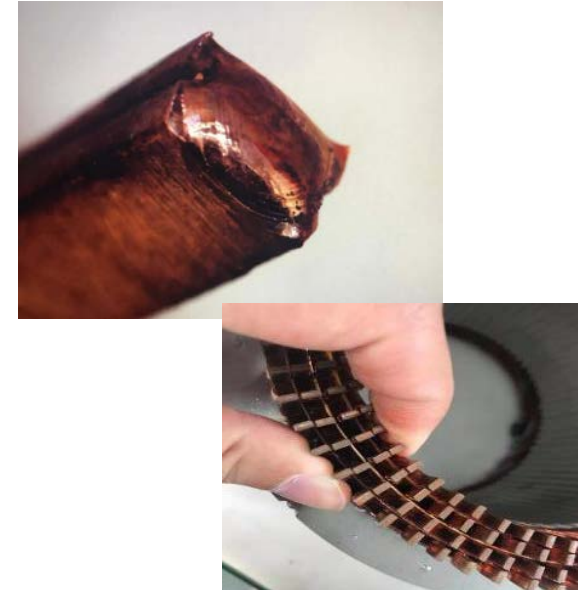
Type	redPOWER QUBE 300W – 2kW
Power	2kW
Focused spot size	35µm
Beam Ø	
Speed	Linear speed of spiraling beam: 1m/sec
Welding time	0.5sec

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