Humping Reduction Methods for High Speed Laser Welding

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Abstract

Conventional pulsed laser welding is typically done at speeds on the order of millimeters per second, which is too slow to be economically feasible for applications such as fabricating bipolar plates for fuel cells. A typical fuel cell stack may have hundreds of feet of welding which must be executed with high precision and no defects. Recent technological advances in both laser systems and beam movement are allowing for dramatic increases in welding rates. High average power (500 Watt) continuous wave fiber lasers can be coupled directly into galvanometric beam steering systems to achieve welding rates approaching meters per second. At these high travel speeds a defect know as "humping" is common. Humping is a result of weld pool elongation, which causes irregular solidification of the weld crown. This irregular weld crown includes lack of fusion defects that can lead to premature weld failure. Mound Laser & Photonics Center, Inc. (MLPC) has developed unique welding methods to mitigate humping in high speed welds utilizing a combination of beam path and focus control. This paper will discuss how different weld techniques are being utilized to mitigate the humping defect while maintaining high processing speeds.

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