

# 热输入对 Al<sub>2</sub>O<sub>3</sub> 陶瓷激光焊接表面形成的影响

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**摘要:** 目前, 陶瓷焊接成型成性是制造业面临的一个巨大挑战。本文开展了 Al<sub>2</sub>O<sub>3</sub> 陶瓷的激光焊接研究, 对比分析了激光功率、焊接速度、激光占空比等工艺参数对焊缝宏观形貌、焊缝裂纹率及焊接接头性能的影响。结果表明, Al<sub>2</sub>O<sub>3</sub> 陶瓷焊缝开裂倾向较大, 其激光功率应与焊接速度适度匹配。焊缝裂纹率随热输入增加呈现先减小后增大的趋势。当连续激光焊接的热输入为 17-20.5 J/mm, 脉冲激光焊接的热输入范围 20.5-24 J/mm 时, 可以获得焊缝裂纹率低于 30% 且抗弯曲强度高于 4 MPa 的陶瓷焊接接头。此外, 在高热输入条件下, 与连续激光相比, 脉冲激光焊接降低了焊缝开裂的倾向。然而, 但脉冲激光焊缝成型是否连续和均匀仍然依赖于焊缝成型因子。

**关键词:** 陶瓷焊接, 焊缝形貌, 裂纹缺陷, 线能量

## Effect of heat input on surface formation in laser welding of Al<sub>2</sub>O<sub>3</sub> Ceramic

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**Abstract:** Ceramic welding into formability is currently a massive challenge for the manufacturing industry. In this article, the laser welding of Al<sub>2</sub>O<sub>3</sub> ceramics was carried out to compare and analyze the influence of laser power, welding speed, laser duty cycle, and other process parameters on the macroscopic morphology of the weld, weld cracking rate, and welded joint properties. The results show that Al<sub>2</sub>O<sub>3</sub> ceramic welds have a greater tendency to crack and that the laser power should be matched to the appropriate welding speed. When heat input increases, the weld cracking rate decreases and then increases. Ceramic welded joints with a weld cracking rate of less than 30% and a bending strength of more than 4 MPa can be obtained when the heat input range is 17-20.5 J/mm for continuous laser welding or 20.5-24 J/mm for pulsed laser welding. In addition, under high heat input

conditions, pulsed laser welding reduces the tendency for weld cracking compared to continuous laser. However, the continuity and uniformity of weld formation with a pulsed laser still depend on the weld forming discontinuity factor.

**Keywords:** Ceramic; Laser welding; Cracking rate; Heat input

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