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激光熔覆工艺参数对 TiC_p/Al 表层复合材料的影响

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摘要: 研究了激光功率、扫描速度对原位合成 TiC_p/Al 表层复合材料与基底的界面结合和熔覆层组织均匀性的影响。通过调整工艺参数, 获得了有良好冶金结合的界面和 TiC 颗粒分布均匀的熔覆组织。结果表明: 在激光功率一定时, 过低的扫描速度将使激光束前端一定距离内的基底材料在表面熔化前被加热时间太长, 以致表面氧化; 而过高的扫描速度会使靠近界面处的粉料中合成反应不能充分完成而残留一些粉末; 这两种情况都影响了熔覆层和基底的结合。随着激光输入比能的降低, 熔覆组织的均匀性降低, 这是由于合成反应未充分完成所致。当激光功率为2200~2500W, 扫描速度为7~10mm/s时, 在ZL104合金表面可获得组织均匀、界面结合良好的 TiC_p/Al 复合材料熔覆层。

关键字: 激光熔覆; 原位合成; TiC_p/Al 基复合材料; 界面结合; 组织均匀性

Influence of technological parameters on interface bonding and structure uniformity of in-situ synthesis TiC_p/Al composites in laser cladding process

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Abstract: The influence of laser power and scanning velocity on interface bonding between clad layer and substrate and uniformity of microstructure in composite surface layer was studied. By means of adjusting these parameters, the excellent interface bonding and uniform microstructure can be obtained. The experiment results show that when the laser power is in a certain value, the lower scanning velocity leads the surface of substrate ahead of laser beam to maintain a longer time at high temperature, so that an oxide film is formed. But, if the scanning velocity is too fast, the synthetic reaction in powder materials near the substrate will be not enough. Either of these two situations will deteriorate the interface bonding. The experiment results also show that the lower the laser input specific energy is, the worse the uniformity of microstructure will

be. This phenomenon is caused by insufficient synthetic reaction in powder materials. When the laser power is 2200~2500W, the scanning velocity is 7~10mm/s, an excellent TiC_p/Al composite surface layer can be obtained on ZL104Al alloy.

Key words: laser cladding; in-situ synthesis; TiC_p/Al composite; interface bonding; uniformity of microstructure

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