

材料工程

基于有限元的激光熔覆凝固过程分析

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摘要:

针对激光熔覆过程中温度变化对其凝固组织的影响,讨论了温度梯度G与冷却速度(即降温阶段的温度变化率)对凝固组织的影响,利用形状控制因子K分析了激光熔覆过程的凝固行为。分析结果表明:在热源中心的正下方晶粒是沿基体垂直方向析出的;冷却速度有细化晶粒的作用,冷却速度越大,晶粒越细小;熔覆材料或基材达到熔点的时间与达到最大冷却速度时间的先后顺序对其凝固组织形态有重要影响,若冷却速度先达到最大值,其组织呈胞状晶粒,否则,其组织呈柱形树枝晶。K在 $80 \times 10^6 \sim 120 \times 10^6 \text{ }^\circ\text{C} \cdot \text{s}$ 时,凝固组织为密布排列且粒径较大的胞状晶粒;当K大于 $200 \times 10^6 \text{ }^\circ\text{C} \cdot \text{s}$ 时,凝固组织为柱形树枝晶。

关键词:

激光熔覆 形状控制因子 有限元 凝固组织

Solidification Analysis during Laser Cladding Process Based on Finite Element

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Abstract:

Finite element was used to analyze effects of the temperature variations on the solidification organization for laser cladding. The influences of the temperature gradient G and the cooling rate (cooling part of temperature changing rate) were discussed.A feature controlling factor K was used to study the solidification performance in the laser cladding process. The results show that the grains precipitate along the vertical direction below the heat source center and the cooling rate plays an important role in refining the grains.The larger the cooling rate is, the less the grains are. It is also found that the solidification structure is significantly dependent on the occurring time of the highest cooling rate and on that of K at the melting point of the cladding or the substrate. It is demonstrated that, if the largest cooling rate is achieved prior to K at the melting point, the structure is of the cellular-grain form. Otherwise, it is of column-dendrite grain form. And when K is in the range of $80 \times 10^6 \sim 120 \times 10^6 \text{ }^\circ\text{C} \cdot \text{s}$, the solidification structure is of densely arranged cellular-grain form whose grain size is larger. When K is more than $200 \times 10^6 \text{ }^\circ\text{C} \cdot \text{s}$, the structure is of column-dendrite form.

Keywords: laser cladding;feature controlling factor;finite element;solidification structurezz')" href="#"> laser cladding;feature controlling factor;finite element;solidification structure

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4. 姜峰;李剑峰;李方义;王玉玲.偏载系数法分析装载机动臂强度[J]. 中国机械工程, 2008,19(3): 272-276
5. 丁雷;尚德广;张大成;贾冠华;李浩群;.基于谐振原理的硅微薄膜弯曲疲劳装置的设计[J]. 中国机械工程, 2008,19(3): 330-334
6. 施欲亮;朱平;沈利冰;林忠钦.汽车前纵梁的拼焊板轻量化设计研究[J]. 中国机械工程, 2008,19(3): 374-377
7. 倪晓宇, 潘长网, 王云霞, 倪中华.
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8. 仇健, 巩亚东, 刘月明, 修世超.
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[J]. 中国机械工程, 2009,20(24): 2922-2927
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10. 陈学东;郭合忠;严天宏;余显忠;.光刻机主基板的动态特性分析及优化[J]. 中国机械工程, 2007,18(21): 0-2527
11. 谢;琴;刘;更;Wang;Qian;Jane;刘天祥;.渗氮钢粗糙表面的弹塑性接触研究[J]. 中国机械工程, 2007,18(22): 0-2747
12. 张;征;刘;更;刘天祥.接触问题的自适应无网格伽辽金方法[J]. 中国机械工程, 2007,18(23): 0-2824
13. 丛明;房波;周资亮.车-车拉数控机床拖板有限元分析及优化设计[J]. 中国机械工程, 2008,19(2): 208-213
14. 许江平;柳玉起;杜亨;章志兵.任意复杂曲面的展平算法及其在五金零件毛坯展开中的应用[J]. 中国机械工程, 2008,19(2): 193-195
15. 周明刚;.黄其柏;王勇.鼓式制动器制动低频振动特性的有限元分析[J]. 中国机械工程, 2008,19(4): 0-465