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电解-磁力复合研磨镍基高温合金 实验研究

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摘要: 为了改善镍基高温合金 GH4169 制造零部件的表面质量,降低其表面粗糙度,提出了一种高效率的电解-磁力复合研磨光整加工方法。设计了电解-磁力复合研磨光整加工的试验装置,与单纯磁力加工对比,对不同加工工艺下所得合金表面的表面粗糙度、表面成分、表面残余应力进行分析。结果表明,在同等条件下,复合研磨使表面粗糙度由 $Ra\ 6.3\ \mu\text{m}$ 降至 $Ra\ 0.8\ \mu\text{m}$,完善了表面质量且加工效率提高 56%;加工后表面成分无太大变化;使表面残余应力由 $+215\ \text{MPa}$ 转变为 $-186\ \text{MPa}$,从而获得更好的表面应力状态。

关键词: 镍基高温合金; 电解-磁力复合研磨加工; 表面粗糙度; 残余应力; 钝化
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The Experimental Research on Electrolytic-magnetic Composite Grinding of Nickel-based Superalloy

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Abstract: In order to improve the surface quality and reduce the surface roughness of the parts made of nickel-based superalloy (GH4169), an efficient electrolytic-magnetic composite grinding method was proposed. A test device of electrolytic-magnetic composite grinding was designed. The surface roughness, surface composition and surface residual stress of the parts under different processing were analyzed by comparing with the simple magnetic processing. Results showed that under the same condition, surface roughness of the parts after composite grinding was reduced from $Ra\ 6.3\ \mu\text{m}$ to $Ra\ 0.8\ \mu\text{m}$, the surface quality was obviously improved and the processing efficiency was increased by 56%, the surface composition did not change much after processing, the surface residual stress was converted from $+215\ \text{MPa}$ to $-186\ \text{MPa}$, resulting in a better status of surface stress.

Keyword: nickel-based superalloy; electrolytic-magnetic composite grinding processing; surface roughness; residual stress; passivation

引言

随着科技的大力发展,零件的使用寿命受到人

们的普遍关注,而零件的表面质量是衡量零件使用寿命的关键^[1]。镍基高温合金有耐高温、比强度高、等优异性能,大量运用于军工、医疗领域,主要用于

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