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电解-磁粒复合研磨对TC4孔棱边毛刺的光整加工

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摘要: 采用电解-磁粒复合研磨加工技术对TC4孔棱边毛刺进行去除,研究了磁极转速、电解电压对TC4孔表面加工质量和加工效率的影响。结果表明:当电解电压9 V、磁极转速1200 r·min^{-1}、磁粒粒径250 μm、研磨加工时间10 min时,孔表面的研磨效果较好,孔边缘处的毛刺完全被去除,孔边表面形貌均匀、平整,表面粗糙度R_a从原始的1.5 μm降至0.16 μm。表面残余应力由原始的+184 MPa变为-53 MPa,由表面拉应力变为压应力。

关键词: TC4孔;磁粒研磨;电解;毛刺;表面形貌;残余应力
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Finishing of Burr of TC4 Hole by Electrolytic-Magnetic Particle Composite Grinding

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Abstract: The TC4 hole edge burr was removed by the electrolysis - magnetic particle composite grinding technology, and the influences of the magnetic pole speed and the electrolysis voltage on the processing quality and processing efficiency of the surface of the TC4 hole were studied. The results showed that when the grinding processing time was 10 min, the electrolysis voltage was 9 V, the magnetic pole speed was 1200 r·min^{-1}, and the magnetic particle size was 250 μm, the grinding effect was better, the hole edge burr was completely removed, the surface morphology of the hole was uniform and smooth, and the surface roughness R_a was reduced from the original 1.5 μm to 0.16 μm. The surface residual stress changed from the original +184 MPa to -53 MPa, and the surface pull stress changed to pressure stress.

Keywords: TC4 hole; magnetic particle finishing; electrolysis; burr; surface topography; residual stress

引 言

TC4钛合金组成为Ti-6Al-4V,属于(a+b)型钛合金,具有良好的综合力学和机械性能。TC4凭借其良好的力学性能、低密度、耐腐蚀性等优点被广泛应用在航空航天领域。随着波音飞机制造技术的开发,TC4材料在波音飞机上的需求量越来越高[1]。TC4材料在零部件装配时,其表面进行钻削制孔以进行零部件之间的装配连接。但零件钻削制孔后,其表面的孔边缘处易产生毛刺、积削瘤等缺陷,严重影响零件之间的装配,导致装配精度比较低。TC4材料的强度与硬度较高,属于难加工材料,传统的表面加工方法很难满足孔棱边毛刺去除的要求。因此,高效去除TC4孔边缘毛刺对于航空

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