磁粒研磨 TC4 孔棱边毛刺的机理及试验研究

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摘 要：目的 探究磁粒研磨法去除 TC4 孔棱边毛刺的机理，寻求去除 TC4 孔棱边毛刺的最佳工艺方案。**方法** 分别对磁极单轨迹运动、磁极复合轨迹运动下磁粒研磨去除孔棱边毛刺的基本原理进行分析，分别利用 ANSOFT 和 ANSYS 软件对孔棱边处的磁场强度和切削力进行模拟分析。通过磁粒研磨法对孔棱边毛刺进行研磨去除试验，利用超景深 3D 显微镜测取孔棱边毛刺的微观形貌以及毛刺的高度。**结果** 磁极为单轨迹运动时，磁极自转转速为 2000 r/min，研磨加工 15 min 后，TC4 孔棱边的毛刺高度由原始的 60 μm 左右降至 5 μm 左右。磁极为复合轨迹运动时，磁极自转转速为 2000 r/min，磁极公转速度为 30 r/min，加工时间为 12 min，TC4 孔棱边的毛刺已经完全去除，且孔表面微观形貌较好。**结论** 当磁极为复合轨迹运动时，相对于传统的磁极单轨迹运动，孔棱边毛刺的去除效率进一步提高，TC4 孔表面微观形貌得到极大改善。

关键词：磁粒研磨；复合轨迹运动；TC4；毛刺；毛刺高度；表面形貌

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Mechanism and Experimental Study of TC4 Hole Burr by Magnetic Particle Grinding

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ABSTRACT: The work aims to investigate the mechanism of removing the burr of TC4 hole by magnetic particle finishing and seek the best technological process for removing burr of TC4 hole. Firstly, the basic principle of magnetic particle grinding was analyzed respectively for single track motion and compound track motion of magnetic pole. Secondly, the magnetic field strength and cutting force at the edge of the hole were simulated by ANSOFT and ANSYS software respectively. Finally, the grinding removal test was carried out by magnetic particle grinding, and the burr height and micromorphology were measured by the ultra deep 3D microscope. When the process way was single track motion, the rotation speed of the magnetic pole was 2000 r/min, the height of the burr of the edge of the TC4 hole was reduced to about 5 μm from the original 60 μm after 15 min grinding. When process way was compound track motion, the rotation speed of the magnetic pole was 2000 r/min, the magnetic pole revolution speed was 30 r/min, the process time was 12 min, and the burr of the TC4 hole edge was removed absolutely and the micromorphology of the surface of hole was better. When the process way is compound track motion, the removal efficiency of burr is further improved compared with that in the traditional single track motion of the magnetic pole, and the micromorphology of the surface of the TC4 hole is greatly improved.

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