

碳化硅晶须增强铝基复合材料自转位刀具车削试验 Experiments on Cutting of SiC Whisker Reinforced Aluminum Composite with Self-propelled Rotary Tools

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关键词: 铝基复合材料 自转位刀具 刀具寿命 切削力

摘要: 采用3种类型的刀具车削航天用碳化硅晶须增强铝基复合材料(SiCw/LD2),用Kistler三向测力仪测量三向切削分力 F_c 、 F_p 、 F_f ,用原子力显微镜AFM检测刀具刃口及已加工表面的微观形貌和轮廓。结果表明,与圆形固定式刀具相比,硬质合金自转位刀具表现出类似金刚石刀具的优异耐磨性,其使用寿命延长60多倍,刀具的切入与切出平稳,切削过程颤振小;已加工表面质量较好,呈现铝基体的灰白铝色,破碎的碳化硅晶须及孔洞较少,表面粗糙度值较小;其三向切削力 F_c 、 F_p 、 F_f 都有不同程度的降低,尤其是平均背吃刀抗力 F_p 减少了30%~60%。硬质合金自转位刀具是切削加工中、低体积分数航天用碳化硅晶须增强铝基复合材料低成本高性能的一类刀具。 Different types of cutting tools were used to cut SiC whisker reinforced aluminum composite. And then the 3-D components of cutting forces F_c , F_p , and F_f were measured with a Kistler 3-D dynamometer, and the microscopic pattern and profiles of the cutting edges and the machined surfaces were examined with an atomic force microscope (AFM). The results showed that, compared with fixed circular cutters the self-propelled rotary carbide tools had superior wear-resistance property similar to that of diamond tools. The tool life had increased more than 60 times with stable cut-in and cut-out and less oscillation in the cutting process. The machined surfaces showed high quality, gray metal shine of the aluminum matrix, smaller surface roughness, and less broken SiC whiskers and pits. The 3-D cutting force components F_c , F_p , and F_f were reduced to some degree. The average radial thrust cutting force F_p had a significant reduction of 30%~60%. The self-propelled rotary carbide tools were thought to be one kind of tools with low cost and high cutting performance and a suitable tool in machining the composites reinforced with SiC whiskers of moderate or lower volume fractions.

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