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5 Influence of milling process parameters on the surface quality of GFRP composites

Abstract: The intensified stiffness and lightweight structural designed components such as glass fiber-reinforced plastic (GFRP) composites are becoming an alternative to metallic materials to improve the performance of aircraft, shipbuilding and automobiles. Machining damages on the machined texture or subsurface due to the catastrophic nature of composites result in rejection of components at the last stage of production cycle, and necessitate the minimization of such damages by improving the manufacturing quality in secondary manufacturing process. In this chapter, various fiber orientation (FO) angled GFRP workpieces were milled with different tool rake angles (RA) of end milling cutters. Random experiments were done to test the effects of important milling parameters, such as spindle speed, depth of cut (DOC), FO angle and tool's RA. The machined wall surface and subsurface were thoroughly analyzed by scanning electron microscope. A reasonable reduction in subsurface damages was observed when using the DOC is low (1 mm) and FO angle of workpiece is less than 90°. At this instance, the machining force and the surface roughness are increased proportionally to a DOC, FO angle of the workpiece and tool RAs, where the surface damages were found to be more. It has also been observed that the damage mechanisms of GFRP composite laminates were dominated by their FO angle.

Keywords: end milling tools, GFRP composites, surface integrity, scanning electron microscope (SEM)

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