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RESEARCH ON THE ANALYSIS OF DRILLING BEHAVIOR TO MINIMIZE DELAMINATION IN CARBON FIBER REINFORCED PLASTICS

Abstract

Composite materials are defined as a combination of two or more materials with a specific property. Carbon fiber reinforced plastic (CFRP) composite is widely used in aerospace and other commercial applications. However, the machinability of CFRP remains a challenge due to the anisotropic behavior and abrasive nature of the composites. Defects in the form of delamination, poor surface quality, and rapid tool wear with flank wear are observed in conventional machining, resulting in high production costs. For this reason, the experiment to analyze the drilling behavior of the CFRP part used for the Thai Space Consortium (TSC) satellite structure is carried out by different methods consisting of conventional drilling with carbide tools and waterjet cutting under different conditions. The CFRP application under two specific conditions is conducted in the earth environment and in the space environment as a thermal vacuum test. This study focuses on the mechanical properties of CFRP using Vickers hardness test and the surface quality of the holes in terms of hole surface morphology, dimensional accuracy and the extent of delamination. The outgassing test is performed in a thermal vacuum to test the materials for their suitability for the space environment. The loss of mass of the sample due to vacuum conditioning at elevated temperature is studied. The reduction of delamination results in CFRP with the different drilling methods can be concluded.

Keyword: CFRP composite, Delamination, Machining behavior analysis, Space environment, Surface quality.