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Study on Tool Wear during Milling CFRP under Dry and Chilled Air Machining (Conference Paper)

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Abstract

Carbon fibre reinforced plastic (CFRP) is an expensive composite that has become a valuable material due to increasing demand from the industry. CFRP is suitable to be used in automotive, aerospace and aircraft industries, due its strength and stiffness properties (higher than steel and titanium respectively) while retaining, while retaining its lighter weight. This paper presents the tool wear on solid carbide cutting tool during milling CFRP under dry and chilled air cutting conditions. The experiments were designed by using Central Composite Design (CCD) with range of 160- 200 m/min (cutting speeds), 0.125- 0.25 mm/tooth (feed rate) and 0.5- 1.0 mm (depth of cut). In this study, air pressure of 0.55 MPa and chilled air (with a temperature of -10 Celsius and a flow velocity of 4.10 m/s) were applied to the cutting tool using a vortex tube. The longest tool lives of 7.22 minutes (dry machining) and 7.33 minutes (chilled air machining) were achieved at the lowest feed rate of 0.125 mm/tooth, a cutting speed of 179 m/min, and depth of cut of 0.71 mm. The polished/shined surface of the tool wear area, which was caused by the abrasive nature of carbon and the sliding mechanism of chips during machining, shows the presence of abrasion wear. Less tool wear was observed under chilled air machining conditions than dry machining. Based on the developed mathematical model, feed rate was identified as the primary significant factors that influenced tool life. In conclusion, the application of chilled air during CFRP machining helped to improve the tool life of uncoated carbide cutting tools compare to dry machining.

Author keywords

CCD CFRP Chilled Air Tool life Tool Wear

Indexed keywords

Engineering controlled terms: Air, Atmospheric pressure, Carbide cutting tools, Carbides, Carbon fiber reinforced plastics, Carbon fibers, Charge coupled devices, Cutting, Fiber reinforced plastics, Fighter aircraft, Flow velocity, Milling (machining), Vortex flow, Wear of materials

Compendex keywords: Aircraft industries, Carbon fibre reinforced plastic (CFRP), Central composite designs, Cutting conditions, Machining conditions, Strength and stiffness, Tool life, Tool wear

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