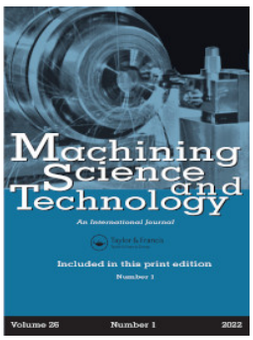

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Influence of milling process parameters and significance of tools to improve the surface quality of GFRP composites

I. S. N. V. R. Prasanth[a], D. V. Ravishankar[b], M. Manzoor Hussain[c], and Chandra Mouli Badiganti[d]

[a]Department of Mechanical Engineering, Malla Reddy Engineering College, Hyderabad, India; [b]Department of Mechanical Engineering, TKR College of Engineering & Technology, Hyderabad, India; [c]Department of Mechanical Engineering, JNTUH, Hyderabad, India; [d]Department of Mechanical Engineering, RISE Krishna Sai Prakasam Group of Institutions, Ongole, India

ABSTRACT

The anisotropic nature of polymer composites presents many challenges for manufacturers to adopt appropriate machining processes. In the present investigation, end milling experiments were conducted on glass fiber reinforced polymer laminates with five varieties of customized cutting tools with different angles of rake and clearance. The performance of the tools was evaluated in terms of their machining force, surface roughness and delamination factor at spindle speeds in the range of 690–2500 rpm. From the observations, relatively high rake and angled clearance tools performed better than the rest of the tools under consideration in terms of delamination and machined surface finishing. The milling operations performed at a spindle speed of 1950 rpm produced better surface quality. Observations from SEM graphs, exposed surface defects due to milling, generated at lower spindle speeds of 690 rpm and at higher spindle speeds of 2500 rpm with the tool signature of low angle rake and angled clearance tools out of all five tools considered for the experiments.

KEYWORDS

Bi-directional glass fiber reinforced polymers; conventional milling; customized carbide tipped tools; surface integrity; SEM

Introduction

Manufacturing techniques commonly used in glass fiber reinforced polymer (GFRP) composites do not require much machining to manufacture a finished product other than trimming and finishing. However, in special cases such as large pipeline fittings and aircraft parts, the milling and drilling of the components cannot be eliminated. As well as end milling is also used in the development of fiber reinforced polymer (FRP) molding tooling systems. Machining is inevitable in special situations where riveted holes and slots are used for mating one component (composite) with others

CONTACT Chandra Mouli Badiganti badiganti1@gmail.com Department of Mechanical Engineering, RISE Krishna Sai Prakasam Group of Institutions, Ongole, India.

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