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THE EFFECT OF MANUFACTURING PARAMETERS ON THE SURFACE ROUGHNESS OF GLASS FIBRE REINFORCED POLYMER MOULDS

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Abstract:

The use of Glass Fibre Reinforced Polymer (GFRP) composite moulds has gained considerable attention in composites manufacturing, especially in open-mould processes; owing to several benefits including ease of processing, maintenance as well as low capital cost of tooling. Nevertheless, the surface of GFRP moulds is susceptible to degradation during the composite manufacturing processes which, if not properly maintained, can significantly increase the cost of repairs; and in severe cases, disposal of the mould may be required. In addition, poor surface quality of a mould can directly result in reduced surface finish of the manufactured part. This study, using a systemic design of experiments approach, investigates the effect of select manufacturing process parameters (de-moulding temperature, amount of release agent and environmental storage condition) on the ensuing surface roughness of typical GFRP moulds as used by industry. For this purpose, an open-mould process was simulated whereby a mould/part assembly consisting of top and bottom chopped fiber laminates with gel coat layers, and the release agent between them, was fabricated and subsequently the cured mould/part assembly was de-moulded under both tensile and shear modes. Specimens were tested at different factor combinations and the statistically significant parameters were identified, via analyzing the force values as well as surface roughness measurements on the moulds using White Light Interferometry. Finally, some practical guidelines were sought on the basis of observed individual and interactive effects of parameters.

Keywords*: GFRP tooling; Surface quality; Environmental degradation; Effect of moulding/de-moulding parameters*

1 Introduction

Composite structures constructed with Glass Fibre Reinforced Polymer (GFRP) moulds often offer a variety of benefits in regards to the product strength, quality and durability. GFRP moulds are today used in numerous composite open-mould processes in structural, marine, and recreational applications, to name a few [1]. Open moulding can consist of spray-up, wet lay-up