LASER CUTTING OF CETEX® THERMOPLASTIC COMPOSITES USING HIGH-POWER MULTIMODE FIBRE LASER

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ABSTRACT

In this paper, investigations on the influence of laser cutting on static strength properties of consolidated thermoplastic CFRP laminates are presented. CETEX® laminates based on a polyphenylene sulfide matrix at four different layer arrangements are cut using a multi mode fibre laser providing a maximum output power of 6 kW. Appropriate cutting parameters have been found, and the results regarding cut quality and heat affected zone (HAZ) are discussed. With these parameters specimens have been prepared and tested regarding static tensile load. The results have been compared to samples treated by conventional cutting technique (milling). Depending on the laminate thickness, the laser treated samples show comparable properties to those of conventionally processed specimens.

1. INTRODUCTION

Continuous carbon fibre reinforced plastics (CFRP) are widely used as a modern construction material in many industrial sectors, such as automotive, aerospace, railway, marine, energy, infrastructure, sports and leisure. CFRP is characterized by high stiffness and strength, excellent corrosion resistance as well as high static and dynamic loading. An outstanding property of CFRP can be found within the potential of significant weight reduction compared to metallic materials. Especially composites based on thermoplastic matrix materials are of rising interest due to their superior producibility, formability and the possibility of realizing welding connections [1-4].

One aspect limiting the use of this material class is the comparatively complex production process. To form an applicable component, CFRP parts in different forms and geometries still have to be trimmed at the edges of the part, resulting in the necessity of cutting technology. Other cutting operations needed may include contour cutting when a complex, flexible contour is needed and inner contours, such as holes or wire feedthroughs.

Today, cutting operations used for CFRP parts are mainly based on mechanical cutting techniques, e. g. sawing, milling, or grinding. Due to its low tool wear, abrasive water jet cutting is also applied.

In terms of a mechanical treatment of CFRP, the polymer matrix and the carbon fibers have significantly different properties, especially in hardness. This difference yields high tool wear which itself in turn causes high costs. If a high precision of a cut is needed, tool life times of a few meters cutting length are not unusual, depending on the thickness and the fibre content of the