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LASER CUTTING OF CARBON FIBRE REINFORCED PLASTICS OF HIGH THICKNESS

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ABSTRACT

Laser cutting of CFRP is an interesting, wear-free alternative to conventional cutting of CFRP with increasing production volumes of CFRP-parts, especially in the automotive and aerospace industries. Cutting CFRP with laser has been investigated by several research groups but was usually limited to thin structures. This paper deals with a new approach to enable laser cutting of CFRP parts with a thickness above 6 mm.

Based on a remote cutting approach, experiments were conducted in order to generate high process speeds and reduce heat affected zones to around 200 µm. It was found that laser cutting may be applied to thicknesses around 6 mm while keeping the width of the cut in the size of the focal spot, before shadowing effects prevent the laser from penetrating deeper into the material. When even thicker laminates need to be cut, parallel passes may be used to widen the cut, and enabling the laser focus to follow into the cut kerf. With the latter approach, CFRP with a thickness of up to 13 mm has been cut.

1 INTRODUCTION

A main approach to reduce carbon dioxide emissions in the transportation sector is the electrification of the drive train. However, the necessary batteries for electrifying the engine-systems lead to a noticeable increase in vehicle weight. Therefore, structural parts made from carbon fibre reinforced plastics (CFRP) become an important part of the material mix, used to design lightweight cars such as the BMW i3-model. The high potential of CFRP-parts for lightweight construction comes at high manufacturing costs [1]. Large shares of those costs are due to cutting, trimming, and drilling operations. The extremely high tool-wear with tool life of typically less than a hundred meters, leads to unsteady cutting qualities near end of tool life and high tool costs while using conventional machining processes such as milling [2]. Cutting CFRP with laser is a wear-free, nearly force-free, and fast process [3]. However, due