

LASER THROUGH TRANSMISSION WELDING OF PIGMENTED GLASS-PEI TO GLASS-PEI

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ABSTRACT

The performance and manufacturing benefits of continuous fiber-reinforced thermoplastics are now widely accepted throughout the aerospace industry. In the field of high power lasers for material processing, advances are also being made with the widespread introduction of new technology multi-kilowatt fiber lasers. The work presented here successfully combines both technologies in the joining of TiO₂-pigmented S2 glass-PEI facesheets and S2 glass-PEI stiffeners. These materials are successfully joined via laser through-transmission welding by making a simple modification to the composition of the lower layer of the joint. Weld parameters, mechanical test results (including lap shear and flatwise tensile strength), and micrography are presented. The results indicate that good weld strength can be achieved at realistic speeds using standard laser optics. There is a strong possibility of scaling these results up to much higher speeds, larger panel sizes, and many different material combinations; this will expand the opportunities for this technique considerably.

1. INTRODUCTION

1.1 Introduction to Laser Processing of Composites

Over the course of many years there have been a multitude of attempts worldwide to employ lasers in the processing of aerospace composites, but in the case of subtractive laser processes such as laser cutting and drilling, these have almost always ended in failure. Attempts have been made to use almost every type of industrial laser for these tasks, but while good results can be achieved with some of the newer types of ultra-short pulse lasers for ablative processing, these

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