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Effects of various aluminum surface treatments on the basalt fiber metal laminates interlaminar adhesion

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Abstract: Fiber metal laminates (FMLs) are a new class of advanced materials consisting of metal and fiber reinforced polymer layers. Surface treatment of the metal layers can have significant effects on the interlaminar properties and thus the overall properties of FMLs. The aim of this study was to apply four different surface treatment methods on the aluminum layers and investigate their effects on the flexural behavior of a FML made up of Al2024, basalt fibers and epoxy Epon 828. To study the surface morphologies and fracture surface of samples, scanning electron microscopy (SEM), optical microscopy (OM) and profilometry were utilized. Results of the four methods applied, showed that the mechanical abrasion and alkaline etching treatments were not found suitable for enhancing the flexural properties due to weak interfacial adhesive bonding. OM images revealed that the adhesive failure was the failure type of mechanical abrasion and alkaline treated samples. On the other hand, Forest Products Laboratory etching (FPL-etching) and anodizing treatments caused significant improvements in the flexural properties. The improvements are attributed to the formation of surface oxide layers containing microscale pits. The microscale pits provided appropriate sites for the penetration of the polymer resin, which caused strong interfacial bonding by mechanical interlocking mechanism. Moreover, SEM and OM images indicated that the main failure type of FPL-etching and anodized samples was the cohesive failure.

Keywords: FMLs, Surface treatment, Anodizing, Flexural properties

1- Introduction

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