

DESIGN ALLOWABLES FOR COMPOSITE BONDED JOINTS IN AIRCRAFT STRUCTURES

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ABSTRACT

This paper addresses the combined effect of the environmental conditions and the manufacturing methods on the bonded joint strength. The specimens were fabricated in four different methods and then were tested in three different environments. Among the manufacturing methods, cocured joints showed the highest strength. In terms of the environmental condition, the elevated temperature and wet condition gave the best results.

I. INTRODUCTION

One of the key areas in composite structural design involves the joint strength. It is also well known that the mechanical properties of composites and adhesives change depending on the temperature, moisture and chemical environments. However, research on the effects of environmental conditions on composites mostly concerns the study of the material properties of the composites. In this paper, the effects of the environment and manufacturing method on the strength of composite bonded joints are investigated by test.

II. SPECIMEN PREPARATION AND TEST

A total of 101 carbon-epoxy composite joint specimens were fabricated in four different manufacturing methods: CCA and CCN(cocuring

with and without an adhesive), SEB(secondary bonding) and COB(co-bonding) and were tested in the three different environments: RTD(room temperature/dry), ETW(elevated temperature/wet) and CTD(cold temperature/dry).

III. RESULTS AND DISCUSSION

In all environmental conditions, the CCN showed the highest strength and was followed by the SEB or the COB. The strengths of the joints in the ETW condition were 11% ~ 23% higher than those in the RTD environment. While the strengths of the joints in the CTD condition decrease by 8% ~ 21% compared to those in the RTD environment, the strength of the COB joint increases by more than 30% compared to this type of joint in the RTD condition. The results suggest that the ETW condition increases the delamination strength of the laminate and decreases the adhesive shear strength. It was also found that the CTD environment improves the adhesive strength and accelerates delamination of composite laminates.

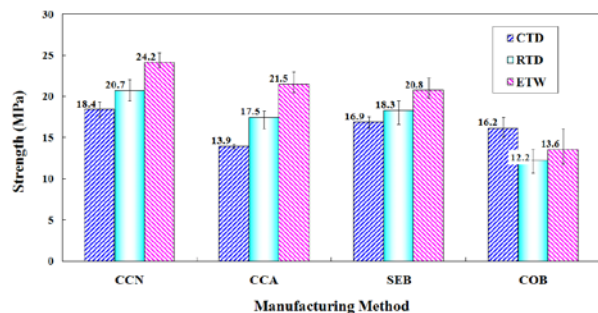


Fig. 2: Strengths of the bonded joints



Fig. 1: Test set-ups for ETW(left) and CTD(right)

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