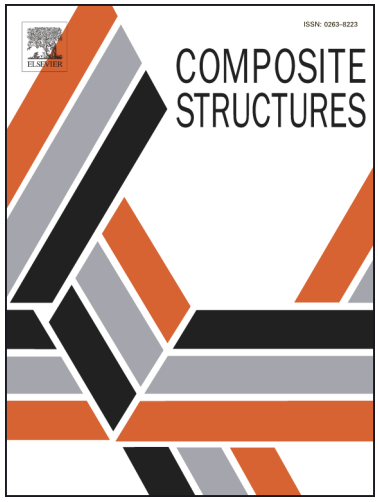

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MECHANICAL CHARACTERIZATION OF CFRP/STEEL BOND CURED AND TESTED AT ELEVATED TEMPERATURE

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Abstract

Glass transition temperature (T_g) of the bond between CFRP and steel influences on the service and fire performance of strengthened members. A total of eighty-two CFRP/steel double strap joints were prepared and tested under elevated temperature. They were cured under a range of elevated temperature conditions in the control laboratory environment and in the open environment which is practically feasible in large civil engineering structures. The test results showed a similar trend of reductions in the bond strength, Poisson's ratio and Elastic modulus of CFRP/steel joint with the exposure to the elevated temperature. More than 50% reduction in the Poisson's ratio, elastic modulus and the bond strength was noted when the bond line temperature exceeds T_g + 15 ^{0}C, irrespective of the curing time and curing conditions. Initial elevated temperature curing also causes for shifting the curves in the right-skewed direction. A significant increase in T_g of bond was noted with 4 hours initial curing at 75 ^{0}C, i.e. T_g +20 ^{0}C.

Key words: CFRP/steel, Elevated temperature curing, Glass transition temperature, Fire, Bond characteristics

1. Introduction

The use of Carbon Fiber Reinforced Polymer (CFRP) composites is increasing in recent years in the construction industry due to its superior properties. CFRP applications in steel structures can widely be seen in outdoor structures such as bridges and towers. These structures directly expose to the environment. Hence, it is important to investigate the possible alternatives to enhance the service performance of the composites.

Nguyen et al. [1] investigated the behavior of CFRP/steel composite when it is exposed to the elevated temperature. Effects of elevated temperature on the CFRP/steel joints cured at ambient conditions were investigated with respect to the different CFRP layer types, adhesive types, exposure conditions etc. [2-7]. However, the effects of elevated temperature curing in the range of temperatures around the glass transition temperature (T_g) of polymeric bonds of the steel/CFRP double strap joints and their behaviour at elevated temperature had not been investigated in the latter studies. A significant degradation of bond properties was noted. Most of the polymeric adhesives which are commercially available have a very low T_g which is less than 60 ^{0}C [8,9]. Curing condition of the epoxy adhesive