BOND BEHAVIOUR OF ELEVATED TEMPERATURE CURED BOND BETWEEN CFRP AND CONCRETE SUBJECTED TO LONG TERM EXPOSURE OF LOW ACIDITY

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The Research Thesis was submitted in partial fulfilment of the requirements for the Degree of Master of Science in Structural Engineering Design

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DECLARATION

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Prof. (Mrs) J.C.P.H. Gamage

ABSTRACT

Rehabilitation and strengthening of infrastructures has become important in Structural Engineering as it is cost effective than newly construction and rebuilding due to the increasing prices of the global market and expensive workmanship. For the concrete members with external strengthening using CFRP under aggressive environmental conditions, the bond between the CFRP and the concrete surface significantly affects the strength of externally strengthened concrete members. Thus, it is essential to investigate the overall response of the concrete members externally strengthened with CFRP that exposed to different environmental conditions. As a side effect of heavy industrialization, it releases toxic gases in environment and contributes to produce acid rains. Further, lots of concrete structures in these areas that often included sulphuric acid are exposed to acid rain erosion. Generally, exposing concrete in acid environments is the main debate about durability of concrete structures. On the other hand, deterioration of sewer pipes and waste water purification structures attacked by sulphuric acid is a global challenge which already have lots of economic concerns all around the world.

Limited research studies have been carried out on the behaviour of CFRP-concrete composite under long term exposure to acidic environment. Moreover, lack of research data and design guidelines adversely effect on popularization and application. When the glass transition temperature (T_g) of adhesive bond is comparatively higher than the environmental temperature, the resistance of the bond to the aggressive environment increases. Hence, this research is an attempt to study the bond behaviour of elevated temperature cured bond between CFRP and concrete subjected to long term exposure of low acidity.

In this study, an experiment was conducted on elevated temperature cured bond between CFRP and concrete subjected to long term exposure to the low acidic solution in order to investigate a suitable curing technique to improve the stability of bond between CFRP and concrete. Ambient condition was used as the reference and low acidic solution of pH 5 value was used as an experimental corrosive medium. Elevated temperatures of 65°C and 75°C was used as the different curing condition and exposure periods were 15 days, 30 days and 90 days.

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LIST OF ABBREVIATIONS

Abbreviation	**Description**
C40	Characteristic cube compressive strength is 40 N/mm^2
C40/50	Characteristic cylinder compressive strength is 40 N/mm^2 and characteristic cube compressive strength is 50 N/mm^2
C60	Characteristic cube compressive strength is 60 N/mm^2
CFRP	Carbon Fiber Reinforced Polymer
CFS	Carbon Fibre Sheets
EBR	Externally Bonded Reinforcement
EBROG	Externally Bonded Reinforcement On Grooves
FRP	Fiber Reinforced Plastic
RC	Reinforced Concrete
UV	Ultraviolet

LIST OF SYMBOLS

Symbol	Description	
T_g	Glass transition temperature	°C