Bond Performance of Ribbed Type of GFRP Rebar to Concrete at High Temperature

Jongsung Sim
Professor
Hanyang University
Seoul, Korea
jssim@hanyang.ac.kr

Do Yung Moon
Research Professor
Korea University
Seoul, Korea
dymoon@korea.ac.kr

Taesung Kang
Ph.D. candidate
Hanyang University
Seoul, Korea
bigstar@hanyang.ac.kr

Jisoo Park
M.S. course
Hanyang University
Seoul, Korea
rabenda85@hanyang.ac.kr

Summary

This study focuses on the bond performance of ribbed type of GFRP rebar to concrete at high temperature and discusses the results of pullout tests. Pullout tests of ribbed type of GFRP rebars embedded in concrete are conducted to obtain an accurate bond stress-slip laws and also to closely observe the state of the surface of pulled-out rebars at failure to accurately categorize the mode of failure. The effect of temperature on the bond strength is Similar trends can be seen for all the GFRP rebars; relatively high bond strength is seen at room temperature. As the internal temperature increase to approximately 60~100°C, a reduction in the bond strength can be seen.

Keywords: GFRP, Bond, Rebar, High temperature, Pullout test

1. Introduction

The bond behavior of FRP reinforced concrete structures at normal temperature is relatively well-established while information regarding the bond behavior of FRP at high temperatures is still missing. The behavior FRP rebar reinforced concrete under fire exposure is quite different from the conventional reinforced concrete(Saafi, 2002; Elbadry et al., 2004; Katz et al., 2000, 1999; Aiello, 1999; Ningyun et al., 1995). When embedded in concrete, the lack of oxygen will inhibit the burning of FRP reinforcement, but the resin will soften. The critical time will be when the resin on the surface of the FRP bar reaches its glass transition temperature. At this point will no longer be able to transfer stresses from the concrete to the fiber, i.e., the bond will fail(Katz et al, 2000). Locally, this may result in increased crack width and hence in increased deflections. Collapse will occur when the temperature of the fibers reaches the level at which they start to degrade(Elbadry et al., 2004).

This paper presents the bond behavior of proposed GFRP rebar to concrete under thermal loading state and discusses the results of pullout tests. To investigate the bond performance of proposed GFRP rebar with concrete subjected to thermal loading, direct pull-out tests were conducted in this paper.

2. Experimental details

2.1 Specimens

A schematic diagram of the specimen is shown in Fig. 1. Each test specimens used in this study was composed of two concrete blocks: fixing and loading blocks. Each concrete block had a section of 150 × 150 mm and had a length of 170 mm and 150 mm respectively. The reinforcing bar was cut into 530 mm-long sections. One end of the bar sample was completely embedded in the concrete block (150 mm long) and the other was embedded with length equal to 70mm. The PVC pipe was

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