

Accepted Manuscript

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Strengthened with Fiber Reinforced Polymer

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PII: S0263-8223(17)34142-9
DOI: <https://doi.org/10.1016/j.compstruct.2018.09.028>
Reference: COST 10174

To appear in: *Composite Structures*

Received Date: 9 May 2018
Revised Date: 18 August 2018
Accepted Date: 17 September 2018



Please cite this article as: Liang, H., Li, S., Lu, Y., Hu, J., Liu, Z., Electrochemical Performance of Corroded Reinforced Concrete Columns Strengthened with Fiber Reinforced Polymer, *Composite Structures* (2018), doi: <https://doi.org/10.1016/j.compstruct.2018.09.028>

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Electrochemical Performance of Corroded Reinforced Concrete Columns Strengthened with Fiber Reinforced Polymer

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Abstract: External bonding of fiber reinforced polymers (FRP) has been widely used to strengthen corroded reinforced concrete columns. During the application of FRP, the variations of electrochemical parameters, such as corrosion current density and charge transfer resistance, have a significant effect on the understanding of anti-corrosion protection mechanism of FRP. Therefore, this study conducted the electrochemical measurements of corroded reinforced concrete wrapped with FRP. The considered variables included pre-corrosion degrees (1%, 3%, and 6% theoretical mass losses) and anti-corrosion protection methods (non-protection, carbon FRP wrapping, glass FRP wrapping, and epoxy coating). The measurements included half-cell potential, linear polarization, and electrochemical impedance spectroscopy (EIS). By analyzing the variation of the above electrochemical parameters in the whole exposure period, it was concluded that FRP wrapping cannot stop the elicited corrosion response but were effective to reduce the corrosion rates, and the main contributor was the epoxy used as an adhesive between concrete and FRP. Moreover, clear inductive loops were observed in Nyquist plots. According to the fitting results, the inductance values were significantly larger for FRP wrapped specimens and less corroded specimens. The inductance may be owing to the difficulties for diffusion of corrosion products.

Keywords: reinforced concrete; corrosion; FRP; electrochemical performance

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