Mathematical analysis on the durability of basalt rebars in acidic environment

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ABSTRACT

Fiber reinforced polymer materials have been used as the alternative to conventional steel reinforcement within the construction industry. While Basalt fiber reinforced polymers (BFRP) have shown improved mechanical properties and durability performance compared to conventional steel, it is not immune to degradation and corrosion when subjected to harsh environments. As such, significant studies have been conducted to simulate the mechanical properties of BFRP bars under degradation when subject to different hostile substances. However, there is no standardized conclusion for the performance of BFRP under an acidic environment and in-depth microstructure evaluation as the degradation of BFRP is influenced by myriad factors. This study aimed to produce a Response Surface Methodology (RSM) model to study the effect of pH, temperature, and immersion time on the tensile strength and elastic modulus. Data from existing literature involving acid emersion of BFRP were collected and modelled using RSM to present an overview of the degradation behavior of BFRP. In addition, a synthesis of the microstructure of BFRP reinforcing bars exposed to the acidic environment was evaluated by referring to SEM and EDX. It was concluded that the tensile strength loss due to corrosion was affected by temperature and immersion time in a linear function. On the other hand, tensile strength drop occurred exponentially as an acid with higher pH was used. Hence, the paper revealed the influence of various factors on the corrosion rate of the BFRP rebar.

KEYWORDS

Basalt Fiber Reinforced Polymer; Response Surface Methodology; Tensile strength; Elastic modulus; Damage mechanism; Acid solution

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