Experimental and Numerical Investigation of Fire Effect on GFRP Sheets Used in Strengthening RC Structures Considering Anisotropic Properties of Composite Materials

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Abstract

In this study a model is presented to predict the residual strength of composite laminates exposed to the heat flux of fire. This model calculates the number of the damaged laminas considering the charred thickness of the composite laminate and then predicts the overall residual strength of the laminate analyzing each lamina. Charred laminas no longer have their initial properties due to decomposition of their polymer matrix. This model can obtain the damaged thickness by introducing a damage temperature, and solving the energy equation for the thermochemical response of the laminate. The thickness of the charred layer is measured for the laminate after exposure to different heat fluxes and times. The residual strength of the laminate is investigated under tensile, buckling and bending loads. Comparisons are made between the predicted results of thermal and mechanical models and those obtained experimentally. Good agreement was observed between the results of mathematical and experimental models.

Keywords: High temperature Fire damage; Composite laminated; Thermal decomposition; Residual strength.