Using Artificial Neural Networks for Predicting Mechanical and Radiation Shielding Properties of Different Nano-Concretes Exposed to Elevated Temperature

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Abstract: This study aims to investigate and predict the effects of adding different Nano additives (Nano alumina, Carbon Nanotubes, and hybrid mix of both materials) within normal strength concrete on both mechanical and gamma ray radiation shielding properties of concrete after exposure to elevated temperatures. Both residual compressive strength (RCS) and gamma ray's linear attenuation coefficient (μ) tests were used as an indicator of the change in properties after exposure to elevated temperature. While the results showed remarkable positive effects for all Nano additives at all replacement ratios, the hybrid mix of 1.5% Nano alumina (NA) along with 0.1 Carbon Nano tubes (CNT) showed the optimum enhancement for both the mechanical and radiation shielding properties. A smart modelling Artificial Neural Networks (ANN) was also developed for predicting the values of RCS and μ for the different concrete mixtures. The type and the proportion of Nano additives, the temperature, and the elevated temperature exposure time were input variables for the neural networks. The predicted values of RCS and μ are the outputs. The prediction results obtained from the developed ANN showed a high agreement with the experimental results and the predictive capability of developed models was better compared to regression analysis.

Keywords: Radiation Shielding, linear attenuation coefficient, Artificial Neural Networks, Concrete, Nano alumina, Carbon Nanotubes.