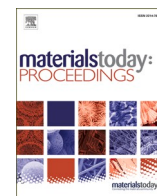




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Artificial neural networks for the prediction of mechanical properties of CGNP/PLGA nanocomposites

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ABSTRACT

The mechanical properties of composite-based components have an impact on both their quality and efficacy. As a result, a scientific framework is needed to discover the practical set of progression constraints that will result in exceptional mechanical qualities. The possibilities of an artificial neural network (ANN) for predicting mechanical properties—specifically, the density and hardness of a carboxyl decorated graphene Nanocomposites (CGNP)/Poly Lactic-co-Glycolic Acid (PLGA) nanocomposite created under various spark plasma sintering (SPS) operating conditions—are explored in this work. A back-propagation with a 2–10–2 structural design and Levenberg-Marquardt algorithm was advanced to anticipate the automated performance of CGNP/PLGA nanocomposites in expressions of density and hardness parameters. The hypothesized outcomes of the models were compared to the actual experimental value. Density (0.9842) and hardness (0.9737) were found to be near to one; the archetypal accomplished well, with a good correlation coefficient (R) for both outputs and a low root-mean-squared error. The anticipated data findings were found to be quite compatible with the values acquired from the investigational assessment results. Our findings demonstrate the utility of a well-trained ANN method in assessing the density and hardness properties of SPSed CGNP/PLGA nanocomposites. As a result, the ANN system provides an unswerving tool for making decisions that can reduce the high costs involved with the experimental characterization of newly manufactured polymer composites.

1. Introduction

Graphene, a one-atom-thick layer of sp² carbon atoms with a two-dimensional honeycomb lattice, has become one of the materials that have received the most attention in chemistry, physics, materials science, and nanotechnology. Graphene is the world's thinnest and strongest material, with exceptional heat and electricity conductivity. Graphene is commonly employed in electronic devices due to its amazing characteristics [1,2]. Biological applications [3] energy conversion and storage, and nanocomposites are a few examples. Graphene with carboxyl groups Nano-platelets (CGNPs) is an innovative Nano filler with appealing properties such as strong compatibility with most polymers, high absolute strength, and low cost⁴, 5. CGNPs were

employed to underline epoxy amalgamated and epoxy/carbon fiber complex covers in this work to improve their mechanical qualities. The mechanical possessions of CGNPs/epoxy nanocomposite were examined, including eventual tensile power and flexure possessions PLGA, also known as poly lactic-co-glycolic acid, is a biodegradable, biocompatible, and FDA/EMA (European Medicines Agency) authorized copolymer[6,7]. It is commercially accessible in a variety of molecular weights and copolymer ratios, allowing the final PLGA behavior to be tailored to a specific application [8–10]. A composite material is a consolidation of a base substance acknowledged as a medium or a glue and a plaster substantial (support). Stuffing materials might be smithereens, specks, threads, or regular or artificial whiskers. The incorporation of these fillers into polymers leads to amalgamated materials with

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