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Machine Learning Approaches as a Tool for Investigating Properties of Polymer Composites

Abstract: Polymer composite materials (PCM) are advanced materials that combine two or more constituent materials to achieve superior properties. They are widely used across various industries due to their numerous benefits, such as weight reduction in the aerospace industry and the combination of mechanical properties with electrical and thermal conductivity in electronics. However, understanding the relationship between the properties of composites can be challenging. The study of electrical and thermal conductive properties under various operating conditions is complex, and rheological and mechanical tasks also require special attention. In the context of this complexity, the research has focused on the impact of mechanical deformation on the electrical conductivity properties of PCMs. A predictive model based on Boltzmann statistics has been developed to forecast the loss of electrically conductive properties when materials are subjected to mechanical stress. The application of a machine learning predictive algorithm offers the opportunity to develop a robust approach for forecasting the mechanical properties of PCM. All proposed models demonstrate an accuracy rate exceeding 95%, indicating a high level of reliability in predicting these properties.

Keywords: polymer composite materials, machine learning, mechanical properties, electrical conductivity.

Biography: A research expert at Zhejiang Lab, Anna Stepashkina has dedicated over a decade to tackling challenges in polymer science. Holding a PhD from St. Petersburg University of Industrial Technologies and Design, her contributions have been recognized through the publication of more than 50 scientific papers. Her work has significantly advanced the field, and she continues to be a driving force in material innovation.