

Artificial intelligence in numerical modeling of silver nanoparticles prepared in montmorillonite interlayer space

Abstract

Artificial neural network (ANN) models have the capacity to eliminate the need for expensive experimental investigation in various areas of manufacturing processes, including the casting methods. An understanding of the interrelationships between input variables is essential for interpreting the sensitivity data and optimizing the design parameters. Silver nanoparticles (Ag-NPs) have attracted considerable attention for chemical, physical, and medical applications due to their exceptional properties. The nanocrystal silver was synthesized into an interlamellar space of montmorillonite by using the chemical reduction technique. The method has an advantage of size control which is essential in nanometals synthesis. Silver nanoparticles with nanosize and devoid of aggregation are favorable for several properties. In this investigation, the accuracy of artificial neural network training algorithm was applied in studying the effects of different parameters on the particles, including the AgNO₃ concentration, reaction temperature, UV-visible wavelength, and montmorillonite (MMT) d-spacing on the prediction of size of silver nanoparticles. Analysis of the variance showed that the AgNO₃ concentration and temperature were the most significant factors affecting the size of silver nanoparticles. Using the best performing artificial neural network, the optimum conditions predicted were a concentration of AgNO₃ of 1.0 (M), MMT d-spacing of 1.27 nm, reaction temperature of 27°C, and wavelength of 397.50 nm.

Keyword: Artificial neural network; Silver nanoparticles; Green method.