

Optimization of the Micro-Hardness as nano-structure Cu-Cr alloys by the mechanical alloying process with using artificial neural networks and genetic algorithm

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Abstract

A nano structural solid solution of Cu-Cr was prepared by mechanical alloying process. Artificial neural networks (ANNs) program was developed in MATLAB software to establish the relationship between the mechanical alloying input parameters, i.e. weight percentage of Cu and Cr, milling times, ball milling speed and sintering temperature and the Micro-Hardness of products as output. The established model of ANN was employed to optimize the process parameters in genetic algorithm (GA) and confirmation experiments were conducted to validate the optimized parameters that obtained from GA. the optimal condition of nanostructures alloy preparation with the highest micro hardness had been proposed with the mean prediction percentage error was lower than 4.41%.

Keywords: Mechanical alloying, Optimization, Nano composite, neural networks, Micro-Hardness

1. Introduction

Precipitation hardening technique is an important process to produce high strength materials. A suitable alloying element should be dissolved in a matrix and then it will be precipitated by

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