Accepted Manuscript

Characterization of severely deformed new composites fabricated by powder metallurgy including a stage of mechanical alloying

H. Ashuri, A. Hassani

PII: S0925-8388(14)01886-6
DOI: http://dx.doi.org/10.1016/j.jallcom.2014.08.031
Reference: JALCOM 31884

To appear in: *Journal of Alloys and Compounds*

Received Date: 11 February 2014
Revised Date: 11 June 2014
Accepted Date: 4 August 2014

Please cite this article as: H. Ashuri, A. Hassani, Characterization of severely deformed new composites fabricated by powder metallurgy including a stage of mechanical alloying, *Journal of Alloys and Compounds* (2014), doi: http://dx.doi.org/10.1016/j.jallcom.2014.08.031

Characterization of severely deformed new composites fabricated by powder metallurgy including a stage of mechanical alloying

H. Ashuri, A. Hassani *

Faculty of Materials Science and Engineering, Semnan University, Semnan, 35131-19111, Iran

Abstract

Mechanical properties of new composites having a binary matrix of Al-4Cu reinforced with TiO_2 nano particles were investigated. The composites which consisted of 2wt% and 8wt% of TiO_2 reinforcement particles, were fabricated using mechanical alloying and a powder metallurgy route. Morphology, phases and compounds formed during ball milling and densification of samples were studied. With increasing percentages of the reinforcement particles, mechanical properties of the composites were enhanced. Microstructural evolution and mechanical properties changes of the composites after application of twist extrusion (TE), as a severe plastic deformation (SPD) process, were also investigated. It was revealed that the more TE passes the higher hardness and yield strength obtained. In addition, increasing TE passes, led to occurrence of a more homogeneous distribution of the reinforcement particles within the structure, and development of an ultrafine-grained nano-structure. The maximum allowable number of TE passes was found to be four, above which the materials failed.

Keyword: Nanocomposite; Mechanical alloying; Twist Extrusion; Powder metallurgy

1. Introduction

In recent decades, aluminum matrix composites (AMC) with discontinuous reinforcements have vastly been attracted by different industries due to their good mechanical properties. Large number of manufacture routes have been developed to produce these materials among which powder metallurgy (PM) routes have been more considered with several causes. First, in powder metallurgy a controlled phase microstructure can be achieved. On the other hand, lower temperatures used in PM processes make the interphase kinetics be precisely controlled. In PM routes, the powders of elements and alloys are used which might be more inexpensive, and of course, much more effective in reinforcement of the composites. Traditional stages of PM-AMCs

* Corresponding Author: Amir Hassani, email: ahasani@semnan.ac.ir and irsangestan@yahoo.com Telefax: +98231 3354 119