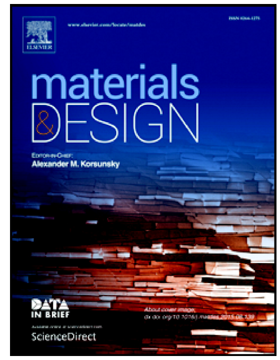
Accepted Manuscript



Investigating the internal structure and mechanical properties of graphene nanoflakes enhanced aluminum foam

Yukun An, Siyi Yang, Hongyan Wu, Ertuan Zhao, Zongshen Wang

PII: S0264-1275(17)30777-3
DOI: doi: 10.1016/j.matdes.2017.08.031
Reference: JMADE 3290

To appear in: *Materials & Design*

Received date: 6 June 2017
Revised date: 29 July 2017
Accepted date: 12 August 2017

Investigating the internal structure and mechanical properties of graphene nanoflakes enhanced aluminum foam

Yukun An[a], Siyi Yang[a*], Hongyan Wu[b], Ertuan Zhao[a], ZongshenWang[a]

[a]School of Mechanical Engineering, Shandong University of Technology, Zibo 255000, P.R. China

[b]School of Physics and Optoelectronic Engineering, Nanjing University of Information Science & Technology, Nanjing 210044, P. R. China

*Corresponding author: yangsiyichina@yeah.net, Tel: +86 13070603662

Abstract

The manuscript focuses on analyzing the pore morphology and pore distribution of novel graphene nanoflakes reinforced aluminum foam (GNF-AF) and investigating their mechanical properties under quasi-static compressive loadings. Experimental results indicate the existence of GNFs can reduce the pore diameter, refine the pore morphology, and improve the pore distribution. Distinguish from other brittle foams, GNF-AF presents smooth stress-strain curve, wherein the local buckling deformation, shear deformation, tensile deformation combinate the whole compressive behavior. By comparing the plateau stress, energy absorption, and specific energy absorption of GNF-AF with varying content of GNFs, a notable improvement of 29.0%, 28.5%, and 27.9% was detected by adding 0.10 wt.% GNFs. Besides, the energy absorption efficiency of enhanced aluminum foam was slightly improved.

Keywords: aluminum foam, graphene nanoflakes, compression test, plateau stress, energy absorption

1. Introduction

Owing to the uniform distribution of pores, excellent performances *(e.g.*, high specific strength, high specific stiffness, sound insulation, and energy absorption) are entrusted to aluminum foam [1-3]. In the past couple of decades, aluminum foams witness a rapid increase in many industrial fields [4], especially in lightweight multifunctional applications [5], where aluminum foam is expected to be used as automotive component with the intent to reduce fuel consumption and improve the collision safety of drivers, passengers and pedestrians [6].

To date, fabrication methods of closed-cell aluminum foams have been exhaustively studied. According to those studies, increasing the thickening of aluminum alloy melt and improving the stabilization of semi-liquid foam attract the most attentions. Ca particles are the most frequently used