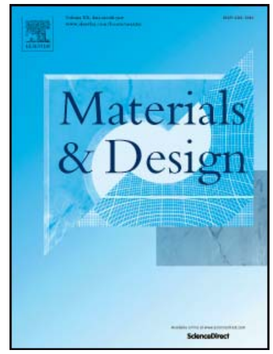
Accepted Manuscript



Elastic properties of silicon nitride ceramics reinforced with graphene nanofillers

Hanuš Seiner, Cristina Ramirez, Martin Koller, Petr Sedlák, Michal Landa, Pilar Miranzo, Manuel Belmonte, Maria Isabel Osendi

PII: S0264-1275(15)30293-8
DOI: doi: 10.1016/j.matdes.2015.08.044
Reference: JMADE 452

To appear in:

Received date: 5 June 2015
Revised date: 15 July 2015
Accepted date: 10 August 2015

Please cite this article as: Hanuš Seiner, Cristina Ramirez, Martin Koller, Petr Sedlák, Michal Landa, Pilar Miranzo, Manuel Belmonte, Maria Isabel Osendi, Elastic properties of silicon nitride ceramics reinforced with graphene nanofillers, (2015), doi: 10.1016/j.matdes.2015.08.044

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

Elastic properties of silicon nitride ceramics reinforced with graphene nanofillers

Hanuš Seiner[b], Cristina Ramirez[a], Martin Koller[c], Petr Sedlák[b], Michal Landa[b], Pilar Miranzo[a], Manuel Belmonte[a], Maria Isabel Osendi[a*]

[a]Institute of Ceramics and Glass (ICV), CSIC, Campus Cantoblanco, 28049 Madrid, Spain.
[b]Institute of Thermomechanics, Academy of Sciences of the Czech Republic, Dolejškova 5, 18200 Prague, Czech Republic
[c]Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague, Trojanova 13, 12000 Prague, Czech Republic

* Corresponding author E-mail address: miosendi@icv.csic.es (M. I. Osendi)
Tel. +347355840; Fax +347355843

Abstract

Elastic constants of silicon nitride composites with variable content (3-18 wt.%) of two kinds of graphene fillers (nanoplatelets and reduced grapehene oxide sheets) are determined using resonant ultrasound spectroscopy. The corresponding Young's modulus (*E*), shear modulus (*G*) and Poisson's ratio (ν) are calculated for each material. Composites show a noticeable anisotropy that grows stronger with the graphene filler content, owing to the preferential alignment of the graphene layers and to their own anisotropy as well. *E* and *G* monotonically decrease with the filler concentration for both types of fillers, showing a maximum decrease in *E* of 75% along the direction perpendicular to the graphene plane for the composite with the highest filler content (Si_3N_4-18 wt% GNP) and a reduction in *G* of 63% for shear along the graphene plane for the same composite. Influence on the fracture pattern of the composites is also addressed.

1. Introduction

Ceramic composites reinforced with multilayer graphene nanofillers and consolidated by Spark Plasma Sintering (SPS) can reach significant toughening enhancement and exhibit electrical conduction as well, thus becoming attractive multifunctional composites. Most of the studies about these composites are devoted to the toughness enhancement in a gamut of ceramic matrices owing to these fillers [1-4]. Nevertheless, not much attention has been paid to examine their elastic properties [5-7], which are fundamental for their structural performance. Actually, this performance can be particularly affected when a preferential orientation of the fillers occurs, such as it happens for graphene/ceramic composites fabricated by SPS [5, 8]. It has been shown that the preferred orientation of the graphene layers induces anisotropy of the electrical and thermal properties of Si_3N_4/graphene composites [9, 10] but also of their elastic constants [6].

Download English Version:

https://daneshyari.com/en/article/7220175

Download Persian Version:

https://daneshyari.com/article/7220175

Daneshyari.com