AENSI Journals

Australian Journal of Basic and Applied Sciences

ISSN:1991-8178

Journal home page: www.ajbasweb.com

Flexural properties for two-ply Glass Fiber Reinforced composites with different loading of CNT/Epoxy film Produced by different Methods

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ARTICLE INFO

Article history:
Received 15 September 2014
Accepted 5 October 2014
Available online 25 October 2014

Keywords:
Glass fiber-reinforced composite, CNTs/epoxy film

ABSTRACT

Background: Composite materials reinforced by glass fibers are widely used in various applications ranging from aerospace to sporting goods due to their remarkable properties including high strength to weight ratio and high modulus to weight ratio. However, the addition of nanoparticles as reinforcement shows promising results for properties enhancements. Unique properties of nanoparticles such as carbon nanotubes (CNTs) make them potential candidates for many applications from mechanical enhancements to electrical and thermal conductivities. **Objective:** In this work, the effect of CNTs loadings and different methods used to fabricate CNT/epoxy film on flexural properties of two-ply glass fiber reinforced composites were investigated. Various CNTs loadings ranged from 0 vol% to 2.0 vol% were used to fabricate the films by using casting and hot press methods. The films were then stacked in between 2-ply of glass fiber reinforced epoxy composite by vacuum bagging process. **Results:** The results shows that the 0.5 vol% cured CNTs/epoxy film fabricated by using hot press method demonstrated better flexural properties compared to other CNTs loadings and fabrication methods. Hot-press sample shows improvements in flexural strength and modulus which were 190.5% and 368.6% respectively followed by casting (187.2% and 360.0%) and prepreg (169.8% and 330.8%) compared to the neat glass fiber composite. However, the glass fiber reinforced composite with 2.0 vol% CNTs film shows lower improvement (72.0% and 152.7%). **Conclusion:** Casting and hot press methods were used to fabricate film and the flexural properties of two-ply glass fiber reinforced composites were investigated. The results exhibited that the flexural properties were influenced by properties of the film, methods to produce film and the adhesion between film and glass fiber mats. For future works, it is aimed to optimize film and laminates processing parameters to enhance structural properties of the fiber reinforced composites.

To Cite This Article: Ervina Junaidi, Ong Boon Kian, Mariatti Jaafar, Sinin Hamdan., Flexural properties for two-ply Glass Fiber Reinforced composites with different loading of CNT/Epoxy film Produced by different Methods. ***Aust. J. Basic & Appl. Sci.,*** *8(15): 383-388, 2014*

INTRODUCTION

Glass fiber-reinforced plastics (GFRPs) composite are widely used in various structural applications such as aerospace, automotive, sporting goods and marine due to their remarkable properties including high strength to weight ratio and high modulus to weight ratio. Composites materials are commonly used due to their adaptability to various conditions and ease of combination with other materials in order to perform specific purposes and achieve desirable properties. However, performance of final composite depends on various parameters such as matrix materials, reinforcing fibers, fiber alignments and fiber directions.

Recent developments in fiber reinforced polymer composites shifted direction towards application of nanoparticles for properties enhancements. The addition of nanoparticles as reinforcement shows promising results for properties enhancements and thus will maximize their applications. Unique properties of nanoparticles such as carbon nanotubes (CNTs) in terms of high mechanical strength and stiffness, exceptional thermal conductivity, low density and high aspect ratio make them very good candidates for many applications from mechanical enhancements to electrical and thermal conductivities (Baughman *et al*., 2002; Zhidong *et al*.,

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