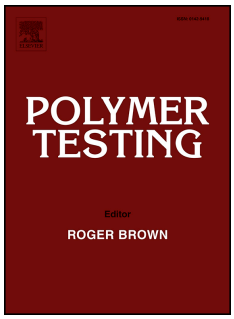
Accepted Manuscript



Static and dynamic behavior of jute/epoxy composites with ZnO and TiO_2 fillers at different temperature conditions

P.A. Prasob, M. Sasikumar

PII: S0142-9418(18)30232-0

DOI: 10.1016/j.polymertesting.2018.04.040

Reference: POTE 5445

To appear in: *Polymer Testing*

Received Date: 7 February 2018

Revised Date: 26 April 2018

Accepted Date: 26 April 2018

Please cite this article as: P.A. Prasob, M. Sasikumar, Static and dynamic behavior of jute/epoxy composites with ZnO and TiO_2 fillers at different temperature conditions, *Polymer Testing* (2018), doi: 10.1016/j.polymertesting.2018.04.040.

Static and dynamic behavior of Jute/Epoxy Composites with ZnO and TiO_2 fillers at different temperature conditions

Prasob PA, Sasikumar M

SMBS, VIT University, Chennai, India.

Abstract

This paper presents the mechanical properties and free vibration characteristic of ZnO and TiO_2 filled woven jute/epoxy composite at room temperature and subzero temperatures of (-40, -20 and 27°C). The composite specimen is manufactured by adding nano ZnO and TiO_2 filler at various weight ratios of 2%, 4%, and 6% using the hand layup technique. The presence of fillers, composite layup and environmental parameters like temperature, frequency, humidity determine the anisotropic composite damping. Here the dynamic response of a cantilever jute/epoxy composite is performed and Young's modulus is also calculated. The dynamic response of the beam is carried out using the Oberst beam technique according to ASTM E 756 which gives the methodology for finding the free vibration characteristics like damping and natural frequency properties at a lower frequency using an impact hammer test set up. The static mechanical properties like tensile strength, compressive strength, flexural strength, ILSS, the impact strength of composite with and without filler is found at room temperature and subzero temperature. The glass transition temperature Tg of the composite is also found out from the DTA curves. Water absorption, one of the environmental parameters of the composite is determined as the composite specimen is natural fibre reinforced. The experimental results showed that the mechanical properties are improved by the addition of fillers. The failure mechanism of the composites is also discussed with the help of SEM images.

Keywords: Nano Filler, PMC, Subzero temperature, Oberst beam, Damping, Natural frequency.

Nomenclature

NF	Nanofiller
VF	Volume Fraction
FS	Flexural Strength
ILSS	Interlaminar Shear Strength
EB	Elongation at break
T_g	Glass transition temperature
NC	Nanocomposite
DTA	Differential Thermal Analysis

1. Introduction

The natural fibre epoxy composite has profound structural applications in modern day life due to the environment-friendly characteristics. Though the epoxy matrix has low strength and stiffness compared to metals, the properties can be enhanced with the use of reinforcements like fibres and fillers. Epoxy composites are widely used in superconductive technology and space industry to fulfill various needs. The foolproof application of these composites can be made sure only if they can perform successfully in the room and cryogenic temperature. The higher thermal contraction of epoxy matrix make its characteristics totally different at subzero temperature compared to its properties at room temperature. However, the mechanical and physical properties of the jute fibre are highly consistent as the fibres normally have a uniform cross section. The highly oriented chain molecules of jute fibre makes it less extensible when tested for strength. Also the jute fibre has low weight and high specific strength almost equaling synthetic fibres. The jute fibre epoxy composite are slowly replacing the secondary and tertiary structural elements which are synthetic fibre based composite materials. The drawback of using jute fibre in composite