



# Flexural Behaviour of Sandwich Composite Panels Fabricated Through Different Vacuum Bagging Techniques

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Three-point bending test,  
Flexural properties.

## Abstract

The experimental investigation here focuses on the fabrication of sandwich panels using a single hot vacuum bag, modified vacuum bag, multiple bag and a single hot vacuum bag with platen compression techniques. The present vacuum bagging system cannot be used to prepare sandwich structures when the pressure needs to exceed one bar for bonding considerations. In order to avoid this issue, a new methodology that follows a modified and then a multiple bag technique is proposed to fabricate sandwich panels with high temperature curing of epoxies. Sandwich composites with glass fabric-epoxy face sheet as skin material and a low density thermoset unfilled rigid foam-Polyisocyanurate (PIR-100kg/cu.m), as core material, are considered here. Specimens are tested for flexure for varied spans and at a constant skin to core weight ratio. The flexural strength, rigidity and shear properties are evaluated from the observations to find the influence of the core and span to depth ratios on the respective properties of the sandwich composites.

The work had been presented at an international conference **Fatigue Durability India 2015**, 28-30th May 2015, IN TATA AUDITORIUM, Indian Institute of Science, Bangalore.

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## Introduction

A composite material can be defined [1] as a combination of two or more materials that results in better properties than those of the individual constituents. The two main constituents of a composite material are reinforcement and a matrix. The main advantages of composite materials are their high strength and stiffness, combined with low density, when compared with bulk materials, allowing for a weight reduction in the finished part. The reinforcing phase provides the strength and stiffness which may be harder, stronger, and stiffer than the matrix. A sandwich-structured composites [2] are a special class of composite materials, fabricated by attaching two thin but stiff skins to a lightweight, but thick core. These materials have increasingly been used in a variety of industrial applications such as [3] marine, automobile industry, aeronautics, and aerospace as it is convenient for designers to design for specific requirements with precision and work with the desired characteristics, due to high strength to weight ratios. Polyisocyanurate (PIR) [5] foams represent the system of choice to produce Glass fabric-faced sandwich panels, providing energy efficiency and compliance to severe fire safety requirements.

The manufacturing techniques are also seen to contribute [6] toward performance of the composite. Vishakh et. al. [2] and Surya Teja Varma [4] have investigated the flexural properties of foam core glass epoxy sandwich composites, followed room temperature vacuum bagging technique. Menta [6] developed a non-autoclave vacuum bag process using atmospheric pressure alone that eliminates the need for external pressure normally supplied by an autoclave or a press is an attractive method for composite fabrication. In order to protect against bag or seal failure, part lay-ups are sometimes 'double bagged'. Double bagging [7] [8] involves placing a first, inner bag over the lay-up which is then sealed to the

tool base. A second, outer bag is placed over the inner bag and is also sealed to the tool base. The various flexural properties of sandwich specimens such as flexural strength, flexural strength per unit width, bending strength per unit width, bending stress, shear strain were obtained under 3 point bending [9][10] to find the sandwich beam flexural and shear stiffness.

## Experimental

### Approach of Investigation

The present investigation deals about fabrication of sandwich panels using four different techniques. A Thermo set rigid unfilled polyisocyanurate foam (PIR) of density 100kg/m<sup>3</sup> is used as core and glass/epoxy as the skin material. The skin to core weight ratio is maintained at 4:1 with volume fraction of 0.3 in the skin for the fibre, and the beams were tested for flexure.

**Table 1: Materials Considered For Fabrication**

Material	Name
Skin Reinforcement	E - Glass Fabric-Plain Weave
Core	PIR-100 kg/m <sup>3</sup>
Resin	LY556
Hardener	EH200

**Table 2: Material Properties of Core**

Properties	PIR-100
Elastic Modulus(M Pa)	14.6 MPa
Poisson's Ratio	0.29

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## **Table of Contents Flexural Behaviour Of Sandwich Composite Panels Fabricated**

1. Understanding the eBook Flexural Behaviour Of Sandwich Composite Panels Fabricated
  - The Rise of Digital Reading Flexural Behaviour Of Sandwich Composite Panels Fabricated
  - Advantages of eBooks Over Traditional Books
2. Identifying Flexural Behaviour Of Sandwich Composite Panels Fabricated
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Flexural Behaviour Of Sandwich Composite Panels Fabricated
  - User-Friendly Interface
4. Exploring eBook Recommendations from Flexural Behaviour Of Sandwich Composite Panels Fabricated
  - Personalized Recommendations
  - Flexural Behaviour Of Sandwich Composite Panels Fabricated User Reviews and Ratings
  - Flexural Behaviour Of Sandwich Composite Panels Fabricated and Bestseller Lists
5. Accessing Flexural Behaviour Of Sandwich Composite Panels Fabricated Free and Paid eBooks
  - Flexural Behaviour Of Sandwich Composite Panels Fabricated Public Domain eBooks
  - Flexural Behaviour Of Sandwich Composite Panels Fabricated eBook Subscription Services
  - Flexural Behaviour Of Sandwich Composite Panels Fabricated Budget-Friendly Options
6. Navigating Flexural Behaviour Of Sandwich Composite Panels Fabricated eBook Formats
  - ePub, PDF, MOBI, and More
  - Flexural Behaviour Of Sandwich Composite Panels Fabricated Compatibility with Devices
  - Flexural Behaviour Of Sandwich Composite Panels Fabricated Enhanced eBook Features
7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Flexural Behaviour Of Sandwich Composite Panels Fabricated
  - Highlighting and Note-Taking Flexural Behaviour Of Sandwich Composite Panels Fabricated
  - Interactive Elements Flexural Behaviour Of Sandwich Composite Panels Fabricated

8. Staying Engaged with Flexural Behaviour Of Sandwich Composite Panels Fabricated
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Flexural Behaviour Of Sandwich Composite Panels Fabricated
9. Balancing eBooks and Physical Books Flexural Behaviour Of Sandwich Composite Panels Fabricated
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Flexural Behaviour Of Sandwich Composite Panels Fabricated
10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
11. Cultivating a Reading Routine Flexural Behaviour Of Sandwich Composite Panels Fabricated
  - Setting Reading Goals Flexural Behaviour Of Sandwich Composite Panels Fabricated
  - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Flexural Behaviour Of Sandwich Composite Panels Fabricated
  - Fact-Checking eBook Content of Flexural Behaviour Of Sandwich Composite Panels Fabricated
  - Distinguishing Credible Sources
13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
14. Embracing eBook Trends
  - Integration of Multimedia Elements
  - Interactive and Gamified eBooks

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