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Manufacturing of Discarded Fishnet/Glass Fiber and Polyester Hybrid Composites for Making the Face sheet of Honeycomb Structures

Michael Raj.F[1], Sahaya Elsi.S[2], Starlin Deva Prince.J[3], Bravin Daniel. E[4], Freeda.S[5]
1 Professor, Stella Mary's College of Engineering, Aruthenganvilai, Azhikal Post -629202, Tamil Nadu, India
2 Assistant Professor, University College of Engineering Nagercoil, Tamil Nadu, India
3,4 Assistant Professor, Stella Mary's College of Engineering, Aruthenganvilai, Azhikal Post -629202, Tamil Nadu, India
5 Assistant Professor, Udaya School of Engineering, Vellamodi, Tamil Nadu, India
Corresponding Author E mail;michaelrajf@yahoo.com

Abstract

The increasing demand in lightweight structures inspired a strong trend towards development of sandwich panels. The concept of sandwich construction is thin, stiff and strong facing sheet is bonded to a thick, lightweight core. Usually face sheets are constructed from high strength materials such as glass fiber reinforced polymer composites or aluminium sheet metal. Though glass fibers are made from silica filaments its manufacture and end use is perilous. Discarded Fishnet are excellent abrasion, chemical and impact resistance. The aim of this paper is to develop face sheet using partial inclusion of discarded fishnet with glass fibers reinforced polyester hybrid composites. Tensile, impact and flexural properties are carried out according to ASTM standards. The highest flexural and impact strength were obtained from discarded Fishnet glass fibers reinforced polyester hybrid composites in this investigation This suggest the possibility of employing discarded nylon fibers in composite face sheet for FRP sandwich panels.

Keywords-Composites; Discarded Fishnet; Experimental strength

I.INTRODUCTION

The use of composite sandwich structures in aerospace and civil infrastructure applications has been increasing especially due to their extremely low weight that leads to reduction in the total weight and fuel consumption, high flexural and transverse shear stiffness, and corrosion resistance [1]. In addition, these materials are capable of absorbing large amounts of energy under impact loads which results in high structural crashworthiness. In its simplest form a structural sandwich, which is a special form of laminated composites, is composed of two thin stiff facesheets and a thick lightweight core bonded between them.

A sandwich structure will offer different mechanical properties with the use of different types of materials because the overall performance of sandwich structures depends on the properties of the constituents [3-5]. Hence, optimum material choice is often obtained according to the design needs [6]. Various combinations of core and facesheet materials are utilized by researchers worldwide in order to achieve improved crashworthiness [7].

The facesheets are strong and stiff both in tension and compression as compared to the low density core material whose primary purpose is to maintain a high moment of inertia [8]. It is assumed that in sandwich structures having foam or honeycomb core all of the primary loading is carried by the facesheets. However, in web or truss cored structures a portion of the primary load is carried by the core.

Over the years, a much number of researches have been conducted on 'green' or 'eco-friendly' materials. There is an increasing awareness to substitute glass fibers because of its environmental issues [9]. Large amount of nylon fibers are discarded every year in India polluting the coastal area [10]. The discarded nylon fibers are continually dumped into the coastal environment [11].

The aim of this paper is to evaluate the experimental strength of facesheet made from partial inclusion discarded nylon fiber with glass fiber reinforced polyester matrix. Flexural, tensile and impact properties are carried out according to ASTM standards.

II. MATERIALS AND METHODS

Discarded nylon fibers are collected from coastal areas. Glass fibers, polyester resin and hardener were obtained from Binani India products, Chennai. Polyester matrix has a viscosity of 10 Poise at 250°C. Two composites were developed by using hand layup technique, composites 1, five layers of glass fiber and composite 2, four layers of glass fiber with inclusion of waste nylon in between glass fiber.

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III. RESULTS AND DISCUSSION

A. Tensile test

Tensile strength at yield and at break two composites was measured by using a Universal Testing Machine. This test was conducted as per the ASTM D 638 specifications. The specimens were cut by using circular saw. The gauge length was set at 100 mm and testing speed was 5 mm/min. The experiments were reproduced five times. Tensile strength and tensile modulus for composite 1 & 2 are more are less same. The reason is composite 2, one layer of glass fiber is replaced by 2 layer of nylon fiber from composite 1 and also nylon fiber have better tensile strength.

B. Impact test

Impact test were carried out on composite specimens in accordance with ASTM D 3029. Specimen was fixed in the slot and impact load was applied, by releasing pendulum. Load required to break specimen was noted down and procedures was repeated for different trials. A minimum of five specimens were tested in each group of the composites. Impact resistance of composite 1 is less than composite 2. The reason is brittle nature of glass fiber.

C. Flexural test

The flexural tests were performed according to ASTM D 790 using Universal Testing Machine at a cross head speed of 5 mm/min. The flexural strength and modulus of the composite 2 is higher than composite 1. The reason is the addition of the glass fibers with the nylon fiber. Elastic property of nylon is high comparable to glass fiber.

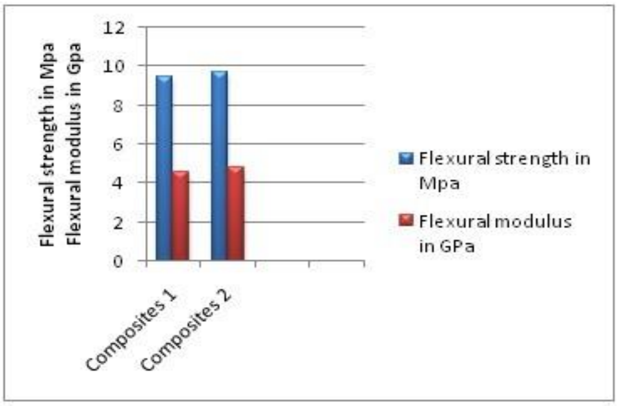

Fig.1 Average Flexural strength and modulus of composite1&2

IV. CONCLUSION

The experimental strength of glass fibers reinforced polyester and glass fiber with partial inclusion of discarded nylon fiber reinforced polyester composites were studied in this work.
From the obtained results, the following conclusions are derived.

- Tensile strength and tensile modulus for composite 1 & 2 are more are less same.
- The composites 2 shows better performance on the flexural strength.
- Better impact energy is obtained in composites 2

From the observations, composites 2 shows moderate performance than composites 1. Hence it is suitable for the application of facesheet in FRP sandwich panel.

References

[1] Borsellino, C., Calabrese, L. and A. Valenza. Experimental and numerical Evaluation of Sandwich Composite Structures. Composite Science and Technology. volume, 64:1709-1715.

[2] Cantwell, W.J., Scudamore, R., Ratcliffe, J. and P. Davies. Interfacial fracture in sandwich laminates. Composites Science and Technology. volume, 59: 2079-2085(1999).

[3] Davalos, J.F. and A. Chen. Buckling behavior of honeycomb FRP core with partially restrained loaded edges under out-of-plane compression. Journal of Composite Materials. volume, 39: 1465-1485(2005).

[4] El Mahi, A., Farooq, M. K., Sahraoui, S. and A. Bezazi. Modelling the flexural behaviour of sandwich composite materials under cyclic fatigue, Materials and Design. volume, 25: 199–208(2004).

[5] Glenn, C.E. and M.W. Hyer. Bending behavior of low-cost sandwich plates. Composites: Part A. volume, 36: 1449-65(2005).

[6] Jianga, H., Huanga, Y. and C. Liub. Fracture analysis of facesheets in sandwich composites. Composites: Part B. volume, 35: 551–556(2005).

[7] Zureick, A., Shih, B. and E. Munley. Fiber Reinforced Polymer Bridge Decks. Structural Engineering Review. volume, 7: 257-266(1995).

[8] Bhattacharyya D, Jayaraman K. Manufacturing and evaluation of woodfibrewaste plastic composite sheets. Polym Polym Compos. volume, 16(6):433–40(2003).

[9] Pflug J, Verpoest I. Sandwich Materials Selection Charts. Journal of Sandwich Structures and Materials. volume, 8:407-21(2006).

[10] Rao S, Jayaraman K, Bhattacharyya D. Short fibre reinforced cores and their sandwich panels:Processing and evaluation. Composites Part A: Applied Science and Manufacturing. volume, 42:1236-46(2011).

[11] Dweib MA, Hu B, O'Donnell A, Shenton HW, Wool RP. All natural composite sandwich beams for structural applications. Composite Structures. volume, 63:147-57(2004).