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Advanced Heliopol/Stratimat Composite Laminate Material Behavior under Cyclic Bending Loads

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Abstract

Within this paper, the material behavior of an advanced composite laminate subjected to static cyclic bending loads have been experimentally determined on an LR5KPlus Lloyd Instruments materials testing machine. The composite laminate structure is formed of HELIOPOL 9431ATYX_LSE resin reinforced with five layers STRATIMAT300 glass fibers of 300 g/m^2 specific weight. One composite specimen has been subjected to various deflection limits to determine its hysteresis behavior. The results show a maximum hysteresis towards 14 mm upper deflection limit.

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Keywords: Heliopol resin; Stratimat; Composite laminate; Three-point bend test; Cyclic bending load.

1. Introduction

Fibers-reinforced composite laminates are widely used in structures that require high strength to weight ratio. Especially polyester and epoxy resins, as embedding materials for glass and carbon fibers, are common constituents of a composite material [1]. Two-phase composites are encountered in many applications but three-phase as well as multiphase composites require special applications. For instance, three-phase composites, known as prepregs, present beside thermoset/thermoplastic resin, glass/carbon/aramid fibers in various forms, and filler as third phase also.

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New Plain 200 Epoxy Based Carbon Prepregs

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Abstract

This paper presents the most important mechanical properties of three new developed prepregs based on 1050 epoxy resin and PLAIN 200 carbon fabric with 200 g/m^2 specific weight used as skins in ultra-lightweight sandwich composite panels with applications in the aerospace industry. Three types of prepregs using one ply, two respective three plies carbon fabric have been developed and then cured in an autoclave with controlled pressure and temperature. From cured plates with 0.2, 0.4 and 0.6 mm thickness, eight specimens from each plate have been cut using a special diamond tool and subjected to tensile tests until break. Various distributions have been experimentally recorded including stress-strain, Young's moduli, load at break-machine extension at break, tensile strengths as well as mean values distributions in case of these three prepregs. Young's modulus, stress and percentage strain at maximum load, force at break, stiffness and tensile strength present an increased tendency with the increase of plies number unlike strain at maximum extension, which presents a decreased distribution with the increase of plies number.

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Keywords: Prepreg; Carbon fibers; PLAIN 200 fabric; Composite skin; Mechanical behavior.

1. Introduction

Plain weave carbon fabrics are extensively used both for medium size composite structures and large size ones due to their high ratio between tensile strength and specific weight. These fabrics present good drape ability, a feature that allows them to be placed on complex shapes. Other carbon fabrics widely used as skins, especially in sandwich structures applications, are so-called twill weave fabrics.

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Advanced RT300 Glass Fabric/Polylite Composite Laminate Simulation

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Abstract

This paper presents numerical simulations regarding the elastic properties of ten plies RT300 glass fabric laminate impregnated with Polylite 440-M888 resin subjected to off-axis loading system as well as a comparison with experimental results obtained in tensile tests on thirteen specimens. To compute the elastic properties, the glass fabric laminate may be equivalent with a new laminate with plies sequence $[0/90]_{10}$ formed of unidirectional reinforced laminae. This equivalence can be considered accurate. Axial, transverse and shear moduli as well as axial-transverse Poisson ratio have been computed. The comparison between numerical simulations and experimental results obtained on "LS100 Plus" Lloyd Instruments materials testing machine show a good accordance between both types of data.

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Keywords: RT300 glass fabric; Polylite resin; Numerical simulations; Composite laminate; Tensile tests.

1. Introduction

Glass fabrics manufactured from unidirectional roving represent the second most used reinforcing material after chopped strand mats. These fabrics present certain number of nodes on square centimeter, certain width and thickness, certain porosity (eye width), bending strength and feature certain surface aspect. The weaving method, threads thickness as well as their twist degree plays a significant role in mechanical characterization of a composite

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FINITE DIFFERENCE TIME DOMAIN (FDTD) CALCULATIONS OF SURFACE PLASMON RESONANCE OF DIFFERENT SIZE AND SHAPE METALLIC NANOPARTICLES

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ABSTRACT. In this work we employ the Finite Difference Time Domain (FDTD) method to calculate the optical spectra and the intensity of local electromagnetic field at the surface of different size, shape and assembling configuration of nanoparticles (NPs) with a view to optimize their sensing activity. We first consider gold nanospheres of 20 nm diameter where analytical solutions are available for comparison. The other shapes we consider include gold nanorods and silver nanoprisms which are particularly important for applications, because they allow tuning the plasmon resonances across the whole visible and near infrared range. The theoretical spectra are compared with experimental data from synthesized samples in our laboratory.

Keywords: nanoparticle, plasmonics, FDTD.

1. Introduction

In recent years, plasmonics has attracted a great deal of attention due to its important potential toward applications in sensing, medical imaging and information processing [1]. This branch of photonics develops new concepts to confine light beyond the diffraction limit and enhance the electromagnetic field at the nanoscale. The past decade has seen significant advances in the synthesis and fabrication of disperse noble metal nanoparticles with a variety of shapes, from spheres to branched multipods. These particles are studied for a large variety of applications due to their localized surface plasmon resonance (LSPR). LSPR occurs when the electromagnetic field of light drives the collective oscillations of a nanoparticle's free electrons into resonance.

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Glass fabric-reinforced Polyte 440-M888 composite laminated subjected to tensile load on warp direction

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Abstract

This paper present and regarding the load-extension from preload distributions of twelve plies RT300 glass fabric-reinforced Polylite 440-M888 polyester resin specimens cut on warp direction, all these behaviors shows present nonlinear distributions. This phenomenon is due to the nonlinear behavior of the Polylite 440-M888 polyester resin since is well known that glass fibers present perfect linear distribution in tensile test. Glass fabrics manufactured from unidirectional roving represent the second most used reinforcing material after chopped strand mats. These fabrics present certain number of nodes on square centimeter, certain width and thickness, certain porosity (eye width), bending strength and feature certain surface aspect.

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Keywords: Glass fibers; Composite laminate; Unsaturated polyester resin; Mechanical properties.

1. Introduction

Glass fabrics manufactured from unidirectional roving represent the second most used reinforcing material after chopped strand mats. These fabrics present certain number of nodes on square centimeter, certain width and thickness, certain porosity (eye width), bending strength and feature certain surface aspect [1,2]. The main weaving methods are:

- Plain weave (in which warp and weft threads pass in a certain sequence one above each other);

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Tensile tests on four layers CSM600 glass fibers-reinforced Polylite 440-M888 polyester resin

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Abstract

This paper presents basic failure modes encountered in four layers glass fibers-reinforced polyester resin specimens subjected to tensile tests until final collapse. Chopped strand mat CSM600 (600 g/m2 specific weight) has been used to reinforce Polylite 440-M888 polyester resin. From a cured plate manufactured at Compozite Ltd, specimens have been cut using a diamond powder mill to avoid introducing supplementary internal stresses in the laminate. First failures modes occurred at 0.012 strain value. Basic mechanical properties such as Young's modulus, tensile strength, load at maximum load, extension at maximum load and other important features have been experimentally determined on a "LS100 Plus" Lloyd Instruments materials testing machine.

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Keywords: Chopped strand mat; Glass fibers; Composite laminate; Polyester resin; Mechanical properties;

1. Introduction

In the manufacturing of composite structures, chopped strand mats represent a common reinforcing material due to their high capability to be impregnated with thermosets. Since the use of chopped strand mats alone lead to low mechanical properties, fabrics and nonwoven polyester mats can be used together with chopped strand mats to increase their overall stiffness [1,2,3,4]. For multiphase pre-impregnated composite materials, using a suitable

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Abstract

Communication has a special role in every aspect of life, therefore it plays a particularly important role it within a company. The present paper presents an entrepreneurial approach to communication, a model of entrepreneurial communication by means of its specific elements in order to prove the necessity of adjusting to the specific characteristics of the area of activity.

Keywords: entrepreneurial; entrepreneurship; commumication; entrepreneurial communication;

1. Main text

The term "communication" comes from the Latin "communist" i.e. "to do joint duty, to share, to say together, to mix, to unite". To communicate means "to make something known, to let someone know, to inform, to notify, to say" or about people, social communities etc., "to put in contact with", also "being related to" or "to lead to" according to Explanatory Dictionary of Romanian Language – DEX –, 1979. According to Shannon Shannon, CF, 1952, who developed in 1952 a model of communication in information theory, communication can be defined as the transmission of a message from one place to another, this process comprising the following elements:
Emitter E - Coding C - channel C - decoding D-receptor R, between transmitter and receiver being a feedback relationship, only after the information has come all the way. Under this scheme, the communication is based on establishing a relationship between a sender and a receptor, namely receiver.

Communication was perceived as an essential element of human existence, even since ancient times. In the middle ages, when the church was in growing development, communication got new dimensions because this period coincides with the formation of the first state formations. This is noted because in each state, there were

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Strategy for the future in terms of research and development in the field of nano and microtechnology

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Abstract

This paper proposes an accounting of this, and the future for this fascinating field of nano and microtechnology. Also want to set up a strategy for the future of the field in terms of existing research, and development domain correlated with the evolution of Europe, the world in general. Actually in speaking of "Micro-and Nanotechnologies" which allow microsystems, components and subsystems, as well as molds with more "micro" and "nano", but in all cases taking into account important features of the area: miniaturization, integration and incorporation of intelligence

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Keyword: the nano and microtechnology; strategy; research; development; characteristics of the area; the future;

1. Introduction

The prefix "nano" is of Greek origin, and "nano" means „dwarf". To get a fair idea of the size, remember that the diameter of a human hair is about 50 000 nm, a bacterium is several thousand nanometers, the size of the smallest integrated transistor which can be found into our computer is in about 100 nanometers, and a string of 10 hydrogen atoms (which is the smallest atom) measures about 1 nm. Also, the human eye does not distinguish details below those of 50 000 nm.

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Properties of advanced new materials used in automotive engineering

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To use composites in design of car components, their mechanical properties are for a great importance. A calculation of the stresses and loads of parts manufactured from composites can be carried out. To determine their mechanical properties, theoretical models can be used. Bearing in mind the differences in the charges of composite materials, even when the same manufacturer produces them, an experimental research is required on these materials. Within this paper, mechanical properties of glass fiber-reinforced HDPE and LDPE as well as carbon fiber-reinforced epoxy resin have been determined experimentally using three-point bend tests.

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Keywords: Three-point bend test, Composites, Mechanical properties, Glass fibers, High-density polyethylene

1. Introduction

Glass fiber-reinforced plastics and composites are frequently used in car building. They are used to replace metals, which are generally expensive and lack in properties. To introduce these materials in the structure of a car, strength calculations need to be carried out, which imply knowledge of mechanical properties. The main methods used in calculations are presented in [1], [2]. In practice, however, results differ from real values, which is because it is impossible to control adequately technological manufacturing processes. As a result, it is necessary to determine experimentally the values of engineering constants. To determine the mechanical characteristics of these types of materials bending tests were applied, more specifically the three-point bend test [3-8].

2. Specimen types used

The method used to determine bending properties is according to Romanian Standard SR ISO 178 and follows other standardized requirements as well. Testing equipment must be in accordance with ISO 5893.

Specimens' dimensions must follow the standard for the given material. The recommended type of specimen has following characteristics:

- Length $l = 80 \pm 2$;
- Width $b = 10.0 \pm 0{,}2$;
- Thickness $h = 4.0 \pm 0.2$.

Regardless of the specimen, the central thickness, over a third of the length should not vary by more than 2% from its mean value. The maximum width variation is 3%. The cross-section must be rectangular and have no rounded edges. During tests following composite materials have been studied:

- Glass fiber-reinforced HDPE and LDPE subjected to pull tests and three-point bend tests;
- Glass fabric-reinforced polyester resin cut on warp direction subjected to three-point bend tests;
- Glass fabric-reinforced polyester resin cut on weft direction subjected to three-point bend tests;
- Carbon fiber-reinforced epoxy resin subjected to three-point bend tests.

Specimens manufactured according to specified standards have been used in pull and three-point bend tests. Figs. 2 and 3 present a series of specimens manufactured of glass fiber-reinforced LDPE (low-density polyethylene). An identical series of specimens have been manufactured of glass fiber-reinforced HDPE (high-density polyethylene). They have been grouped according to the type of test used, in more sample sets, each of them being of ten specimens and a few spares for each sample set. When breaks occurred at the ends, a spare has replaced the specimens.

The influence of dimensional and structural shifts of the elastic constant values in cylinder fiber composites

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The paper analyses the main dimensional and structural shifts that appear in fiber-reinforced composites. Long, aligned fibers are considered to be made up of upright circular cylinders in a regular network. In fact, this arrangement is purely theoretical and impossible to achieve in practice. Dimensional and structural inconsistencies can appear due to the fact that fibers cannot be placed at equal distances, cannot be parallel and layers cannot be placed at equal distances. The paper presents the determination of shifts from theoretical formulae in the structure of composites.

(Received March 2, 2012; accepted April 11, 2013)

Keywords: fiber-reinforced composites, structural deviations, elastic constants, rule of mixtures, Poisson ratio

1. Introduction

During manufacture and afterwards, in the use of composites, a series of imperfections can appear, as well as chemical and diffusion phenomena that will lead to the existence of a significant difference between the composite and its theoretical model. In this case it can be seen, e.g. that the models of hexagonal or rectangular networks are far from the actual reinforced composites with hexagonal fibers.

The following differences can be noted between theoretical models and real materials:

- Differences between the theoretical size of mechanical features of the matrix and reinforcement material and their real values. Due to manufacturing processes, these values in the technical notes can shift from nominal values, which can be influenced by the manufacturer as well. It is necessary to make an analysis in order to establish whether these possible shifts can significantly influence the results obtained with calculations in formulae;
- Differences between the theoretical geometric shape of the reinforcement materials and the geometric shape of the materials used. The precise shapes cannot be obtained in fabrication. For instance, it is difficult to obtain cylinder fibers, due to the shift from circular shape in the manufacturing procedure. It is also difficult to obtain spherical reinforcement materials, as their deviation is smaller or larger than the theoretical shape. Studies are needed to determine the extent to which the deviation can influence the calculations, considering the theoretical geometric shape;
- Dimensional differences of the reinforcement materials. These differences will naturally appear in the fabrication process and it is compulsory to know the extent to which dimensional deviations can influence the behavior of the composite material;
- Differences in the geometric layout of the reinforcement materials. In the studied models, the fibers are considered to be in perfectly hexagonal model or rectangular model, which in many cases is far from being true. In this case, studies must be made to determine how a particular layout with high dispersion, as compared to the theoretical model, will influence the behavior of the composite material.

All these shifts will alter the results obtained on theoretical models (presented, e.g. in [1] and it is necessary to make an analysis to determine which of the formulae used by various authors are the most adequate to analyze a certain type of composite.

2. The influence of dimensional and structural deviations on the value of elastic constants

Dimensional and structural differences of fiber composites can lead to mechanical properties that are different in the real material as compared to the theoretical considerations in ideal conditions of manufacture and use. In [2] an analysis was made of the factors that cause deviations from the theoretical aspects and it was noted that in certain cases these differences could be very big. Measurements to confirm this have been carried out in [4-7]. Fig.1 and fig.2 present, after [3], the distribution of diameters in two types of SMC composites. A normal