Experimental analysis of LDPE and AL_2O_3 using ANSYS: A Review

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Abstract: Literature review of various composite materials, analysis and validation techniques of mechanical properties are discussed in this paper. The focus is kept on analysis and validation of mechanical properties of various composite materials and hence only such research works are included this work in which the use of ANSYS software.

Keywords: Analysis and validation of mechanical properties of various composite materials, ANSYS software.

INTRODUCTION

Materials that are procured from nature cannot keep up with this development. Thus, new searching about materials became compulsory. To meet the material requirements of developing technology, a combined structure is developed which is formed by joining two or more different materials in macro level. This new structure which is called composite material has the superior properties of the materials which form itself. Types and area of usage of composite materials is increasing day by day. Composite material is a material consisting of two or more physically and chemically distinct phase, suitably arranged or distributed. A composite material usually has characteristics that are not depicted by any of its components in isolation.

Composite materials have strong load carrying reinforcing material imbedded in weaker lattice materials. The primary constituent of composites have a non-stop stage which is the significant a piece of the composite is called matrix. Matrices are more ductile and less hard and these are generally either inorganic or natural. Optional constituents of composites have ductile called reinforcements and they are implanted in the matrix. The constituents of composite materials have their own properties, however when they are consolidated together, they give a blend of properties that a singular can't have the capacity to give.

The majority of engineering composite materials in service consist of continuous fibers of glass, or carbon, reinforcing an epoxy polymeric matrix. The epoxy, when polymerized, is an amorphous and a highly cross-linked material. This microstructure of the epoxy polymer results in many useful properties such as high modulus and failure strength, low creep, etc., but also leads to an undesirable property in that it is relatively brittle. These adverse fracture properties may obviously also affect the overall tensile and fracture performance of the FRP composites

Fiber Reinforced Polymer (FRP) composites are widely used in ship hull, airframe, and wind –turbine structural applications due to their high specific strength and stiffness. The components in such structure invariably experience various types of constant and variable amplitude tensile loads in service. Thus, safe operation of the structure for the required technical life time demands that such composite materials, in addition to their good static mechanical properties, need to possess relatively high tensile durability, impact and fracture toughness.

Since the remarkable properties of conventional composites are mainly due to interface interactions, the materials dealt with here (Low Density Polyethylene/Alumina) AL2O3 could provide good model systems in which such interactions can be studied in detail using conventional bulk sample (as opposed to surface) techniques.

LDPE is defined by a density range of 0.910- 0.940 g/cm³. It is unreactive at room temperatures, except by strong oxidizing agents, and some solvent causes welling. It has more branching, so its intermolecular forces are weak, with lower tensile strength, and its higher resilience. Also, since its molecules are less tightly packed and less crystalline because of the side branches, its density is lower. Low density polyethylene is considered as one of the commercially important thermoplastics, especially for their low density, good process ability, and easier mould ability for a wide range of applications.

LITERATURE SURVEY

M.Gutu [1] analysed the finite element model using shell 181 element type, he used Ansys to carry out

his analysis. He carried out vacuum assisted resin transfer molding, for tensile testing Instron 8801 universal testing machine was used. He concluded that there were discontinuities, differences and uncertainties in the specimen.

Tomas Lasota, Jiri Bursa [2] carried out two types of experiment uniaxial tension test and bending test, machines used were ZWIZK with special preparation of three point bending and concluded that unimaterial is suitable only for application where the tension ad compression predominate.

Kalyana Chakravarthy, Dr. Raghunandana.k [3] they used gfrp composite material for testing by hand layup process concluding shell 91 element had no provision for feeding matrix-fiber. Polyester-E-Glass composite was modeled in accordance with the Instron Machine setup used for Flexural Analysis.

Sudhir s Mathapati, TusharT.Hawal, Prashant P. Kakamari, Nikhil R. [4] they used E-glass fibre reinforced epoxy composite carried out tests like tensile and compression. They concluded that the E-glass fiber reinforced epoxy has high ultimate tensile strength and high improvement in the ultimate tensile strength at 3% volume fraction of the glass fiber.

Satnam Singh, Pardeep Kumar, S.K. Jain [5] Materials used in manufacturing of composites Epoxy Resin, Standard Hardener and Glass Fiber Mat, tests carried out were tensile tests and flexural tests with ASTDM standards. Conclusion made was the weight or fiber content in composite can affect the strength of composite.

T. Hariprasad, G. Dharmalingam and P. Praveen raj [6] They tested materials using a UTM Lloyd LR100K Testing Machine, tests like tensile, flexural and impact testing were done.they concluded that an alkali-treated banana-coir epoxy hybrid composite has greater tensile strength and impact strength than an untreated banana-coir epoxy hybrid composite.

Pradeep Yadav, Sonal Dhar, Dr. K.N.Vijaykumar [7] they made use of Halpin-Tsai Equation proceeding with ANSYS. Modelling and defining different layers of composite were done by using Ansys also load applied was calculated.

M.Gutu[8] His samples were made from polyester resin reinforced with fiberglass using technology of vacuum assisted resin transfer molding. Real tests of specimens were simulated with finite element analysis software ANSYS.he concluded that deviations occur between the numerical model and experiment because of the different sizes of elements.

Samson Yohannes Degefe [9] He carried out theoretical as well as fea analysis of the model. He made the simulation in framework of ABAQUS and ANSYS workbench commercial finite element packages. With varoius tests and also modifying the model in order to validate results.

Sandeep. B, Dr. K.S Keerthi Prasad, Girish. T.R [10]. They carried out Finite Elemental analysis is to investigate the various parameter of Natural – polymer hybrid composite material. Test samples according to ASTM D-638 (ASTM STANDARDS) were prepared from the cured sheet using cut-off machine.

Mithun K V, Kennath Joseph D'Coutho,Ligin Cyrilz, Mohammed Mufeed Abdulla, Dr.Kripa Suvarna[11] they conducted tensile, flexural and hardness tests followed by fea analysis. They observed that fiber ratio has major effect on the mechanical properties of the composites like as hardness, tensile strength, flexural strength and impact strength.

Emayavaramban E, Pravin Raj E.L [12] Multi continuum method was used. This test is based on the ASTM D3039. There was little modification made in the testing criteria

Lohitesh Jaga Kumar, praveen D.N., R.Thara, Irfan G [13] ASTM standards were followed, tensile testing and FEA was conducted. The hybridization of Sisal with Coir natural fibers has provided considerable improvement of tensile strength when compared to individual reinforcement.

Ali I. Al-Mosawi [14] Ansys program version (11) was used to calculate tensile strength value for vinyl ester resin before and after reinforced with different weight % from woven roving glass fibers (20%,40%,60%). Low tensile strength of vinyl ester resin, Improvement of mechanical properties after reinforcement by glass fibers.

K.Rajasekar [15] Tensile, compression, flexural and impact tests were performed and analysis by fem method. The fabricated specimen composite will be tested for its mechanical properties using conventional Testing machines and the values recorded. The specimen will also be analyzed using ANSYS software for its mechanical properties and the results are recorded and compared with the experimental results. The results of the analysis will be discussed to identify its properties and find suitable applications. Results were analysed by ANSYS.

srinivasulu, T N charyulu [16] Tensile testing of short CFRP & GFRP, compression test and flexural testing were conducted. The tensile and compressive strength of the short carbon and glass fiber reinforced composite was decreased but the modulus increases with the increase of the filler content.

Ashik K P, Ramesh S. Sharma Subhash Patil [17] Finite element analysis carried using ANSYS to validate the experimental tensile and flexural results. The composites with natural fiber and synthetic fiber increases mechanical strength such as tensile strength, flexural strength, impact strength of the composites with the increase in fiber

S. Irfan Sadaq, Dr. N. Seetharamaiah, J. Dhanraj Pamar, Afroz Mehar[18] The basic philosophy of the method is to replace the structure of the

continuum having an unlimited or infinite number of unknowns at certain chose discrete points. Composite materials with 600 fiber angle is having less deformation and 900 is having minimum strain. Dulgheru, Viorel Bostan, Marin Gutu, [19] Numerical modeling and analysis of the specimen was conducted with bending tests, further by FEA. Numerical modeling and analysis of the specimen was conducted with bending tests, further by FEA.
P.A.Pandav, Dr.V.R.Naik [20] Tensile, bending, fatigue and impact tests were conducted. Analysis was done by ANSYS. The replacement of composite materials has resulted in weight reduction about 64% when compared to conventional mild steel shaft.
B Durga Prasad, G. Kiran Reddy, A. Anusha Yadav [21] Three samples were manufactured for each tests which different by the layers of reinforcement; tensile, hardness and bending stress were conducted. Three samples were manufactured for each tests which different by the layers of reinforcement; tensile, hardness and bending stress were conducted.
S.Krishnaraj, G. Elatharasan [22] AA 6061 alloys were undergone impact and tensile testing. The tensile strength and Impact strength is greatly influenced by the ceramic content/ weight fraction of reinforcement in matrix.
Anurag Thawait [23] The mechanical analysis and ANSYS techniques have been used to investigate the mechanical properties of banana fibre composites. They had resistance to environmental factors, resistance to electricity and chemicals, good machinability for different processes of machining, durable and corrosion resistance.
Adarsh D.K., Andrews R., Banuchandar M., Manikandan R. [24] Comparison of aluminum and carbon fiber using Ansys data, fatigue testing was conducted on both composites. The carbon fiber skin experiences less amount of stress, strain and total deformation than aluminum 2024 alloy for the same load applied at same points.
Erik Barnholt Larsen[25] Tensile test was carried out. Also 3D Finite Element model was created to simulate fracture test in ANSYS 13. As the no. of layers and fibre volume fraction increases, the tensile strength also increases.
P.S. Shivakumar gouda, S.K. Kudari, prabhuswamy. S, dayananda jawali[26] Tensile and fracture tests were performed, modeling the crack region and calculating fracture parametersThe magnitude of the critical stress intensity factor (KIC) is dominant in along the fiber orientation of the CT specimen.
laminates,a.Karthick, karthik prabu B, johnson V, karthik praveen, kiran P[27] Tensile, charpy impact test were performed before fabrication of composite car door, followed by fem analysis using Ansys. The stress ratio had a strong influence on the fatigue life of composites.
Alper atmaca, osman selim türkbaş, mehmet emin erdin, halil aykul, [28] Tensile and shear tests of composite structure is performed, Stress distribution on finite element model by ANSYS. Resin has no effect on strength, Density of resin is low and has no negative effect on weight, In resiny method fibres do not penetrate into matrix.

CONCLUSION

Though much papers are published on mechanical testing of many types of composite material, characteristics and synthetics of many types composite material but testing of LDPE (Al2o3) with void area content is not yet reported.None of the researchers compared void content in composite LDPE and Alumina material in ANSYS. Void defects characteristics of LDPE and alumina have not yet noted in literature.

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