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Synthesis and Mechanical Properties of Araldite/Wooden Powder/Lead oxide/PPY/PANI Composites

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ABSTRACT

In the Present day world, there is a huge amount of work and research being done for various advancements in Composites. This, in turn has led to the innovations in materials and discovery of wide variety of new composites. A **composite material** is basically a material which is made from two or more constituent materials with significantly different physical or chemical properties, which when combined, produce a material with characteristics different from the individual components. This feature helped us to develop various composite materials with desired properties of interest .The mechanical properties of the composites developed is due to the combined effects of matrix composition , reinforcement, hardener and solvents used. This paper highlights the experimental study on the synthesis and mechanical properties such as Ultimate Tensile strength,UL and cross breaking strength of Araldite/wooden powder/Lead oxide/PPY/PANI reinforced epoxy composites. Various Studies were performed by varying the concentrations of Lead oxide,woodenpowder,PANI,PPY(by weight percent) keeping the concentration of Entire composite constant(100%) in the epoxy matrix. The hardener used was HY951 which is hydrophilic in nature. The particles of wooden powder and lead oxide adds to the enhancement of mechanical properties. It was observed that the mechanical properties enhanced for higher concentration of Lead oxide,woodenpowder,PANI ,PPY while decreased for lower concentrations, keeping pure epoxy composite as the reference.

Keywords: Lead oxide; Wooden powder ;PANI; PPY; epoxy; Cross breaking; Tensile ; UL;

I. INTRODUCTION

Due to the rise in the new technologies, there is a need for materials which are Light weight in nature and must be possessing Good strength in order to replace the current Existing materials. Our literature survey reveals that the composites which are made from Lead oxide ,wooden powder etc. Have good mechanical properties than the fiber reinforced composites. One of the reasons for Good mechanical properties is due to the size of particles which makes them possess high Grain efficiency. In our research work ,we used Araldite/wooden powder/Lead oxide/PPY/PANI to make composites. The hardener (HY951) used has low viscosity and helps curing of epoxy resin at room temperature. It undergoes an exothermic reaction with the resin and releases heat. These hardeners being hydrophilic in nature tend to get contaminated on exposure to atmospheric moisture hence, they are stored in a dry place at room temperature in air-tight containers.

The following research work was carried out by using epoxy LY556 as the matrix material. Epoxies are widely used as metal coatings, electronic components, electrical insulations and also as structural adhesives. The advantage of using Epoxy resins is that , it has less Shrinking capacity during curing and great Flexibility and as well as Higher Strength.

The hardener (HY951) used has low viscosity and helps curing of epoxy resin at room temperature very easily and higher filler addition possibility. It undergoes exothermic reaction with the resin releasing heat.

Hardeners being hydrophilic in nature tend to get contaminated on exposure to atmospheric moisture hence, they are stored in a dry place at room temperature in air-tight containers. Polypyrrole (PPy) are conducting polymers which are formed by the polymerization of pyrrole.

In this Research, we have studied the Tensile strength and Cross breaking strength of Araldite/wooden powder/Lead oxide/PPY/PANI composites.

II. EXPERIMENTAL PROCEDURE AND METHODOLOGY

A mold of dimension 200mmX150mmX3mm made of Glass was used. Wax material were applied to the edges of the mold ,so that the composite material once solidified,can be easily removed from the mold ,rather than being sticky onto the surface of the moldcavity.The various composites were prepared by varying the compositions of araldite , lead oxide, PPY, PANI in terms of weight percentage 4%, 2% (Keeping 100% wt as the total wt). Initially a pure epoxy composite was prepared which was used as reference. The reinforcements, matrix and the hardener were mixed thoroughly in a beaker and stirred continuously in magnetic stirrer. Acetone was slightly added for dissolving the reinforcements. The prepared mixture was poured into the wax coated mold cavity and was allowed to cure under room temperature for three days. Thus, fabrication of composites was completed.

The following composites were made and named accordingly, for easy study purpose:
R1 – Pure Epoxy
R2 – Epoxy + 4g Pbo2
R3 – Epoxy + 2g Pbo2 + 2g PANI
R4 – Epoxy + 2g Pbo2 + 2g PPY
R5 – Epoxy + 2g Pbo2 + 2g PANI + 2g Wood powder
R6 – Epoxy + Pure Wood
R7 – Epoxy + 4g Pbo2 + 4g Wood powder
R8 – Epoxy + 2g Wood + 2g PANI
R9 – Epoxy + 2g Wood + 2g PPY

The composites were taken out of the mold cavity and specimens of suitable dimensions were obtained . Composite specimens were prepared according to Indian standards IS: 1998-1962 , Clause 5 for testing the Tensile strength and IS: 1998-1962, Clause 6 for cross breaking strength. The edges of the specimen was filed for finishing and the mechanical properties were tested on a Universal Testing Machine (UTM) .

Figure 1. – Pure Epoxy composite

Figure 2. - Epoxy + 2g of Pbo2 + 2g of PANI

Figure 3. – Epoxy + 4g of Lead Oxide

Figure 4.– Epoxy + Pure Wood

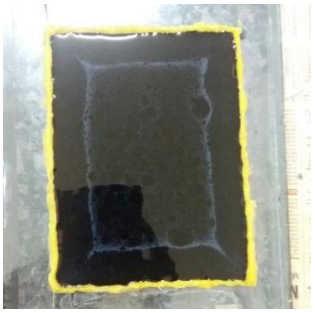


Figure 5. - Epoxy + 2g of Pbo2 + 2g of PPY

III. RESULTS AND DISCUSSIONS

The following images shows the various results obtained by synthesizing these composites :

1) **R1 – Pure Epoxy**

TENSILE TEST

Parameters	**Observations**
Width x thickness,mm	6.30x3.63
Area,mm2	22.869
UL,N	915.00
Tensile strength,Mpa	40

CROSS BREAKING TEST

Parameters	**Observations**
Width x thickness,mm	14.85x3.70
Span length,mm	59
Cross Breaking load,N	203.25
Cross Breaking strength,Mpa	88.5

2)R8 – Epoxy + 2g Wood + 2g PANI

TENSILE TEST

Parameters	Observations
Width x thickness,mm	5.92x3.60
Area,mm2	21.312
UL,N	440.00
Tensile strength,Mpa	21

CROSS BREAKING TEST

Parameters	Observations
Width x thickness,mm	15.00x3.61
Span length,mm	58
Cross Breaking load,N	112.25
Cross Breaking strength,Mpa	50.0

3)R6 – Epoxy + Pure Wood

TENSILE TEST

Parameters	Observations
Width x thickness,mm	6.18x3.63
Area,mm2	22.433
UL,N	830.00
Tensile strength,Mpa	37

CROSS BREAKING TEST

Parameters	Observations
Width x thickness,mm	14.90x3.69
Span length,mm	59
Cross Breaking load,N	114.25
Cross Breaking strength,Mpa	49.8

4) R4 – Epoxy + 2g Pbo2 + 2g PPY

TENSILE TEST

Parameters	Observations
Width x thickness,mm	6.28x3.43
Area,mm2	21.540
UL,N	545.00
Tensile strength,Mpa	25

CROSS BREAKING TEST

Parameters	Observations
Width x thickness,mm	15.03x3.35
Span length,mm	54
Cross Breaking load,N	98.25
Cross Breaking strength,Mpa	47.2

5) R 3 – Epoxy + 2g Pbo2 + 2g PANI

TENSILE TEST

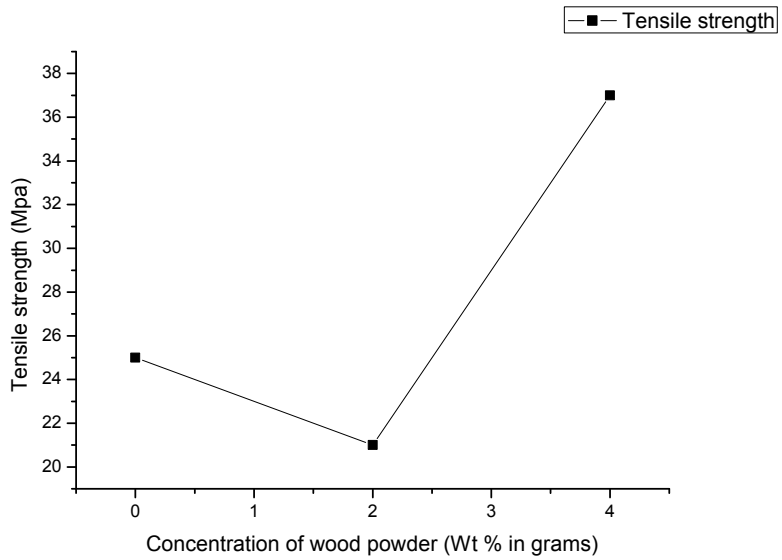
Parameters	Observations
Width x thickness,mm	6.26x3.68
Area,mm2	23.037
UL,N	822.50
Tensile strength,Mpa	36

CROSS BREAKING TEST

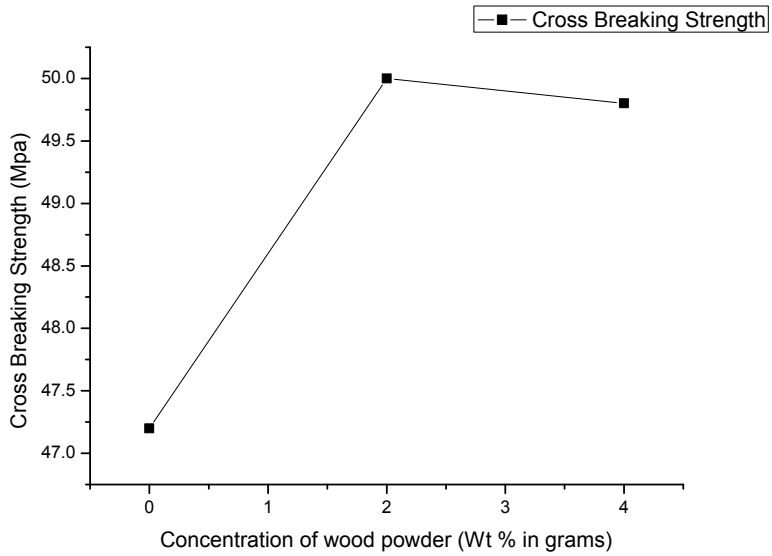
Parameters	Observations
Width x thickness,mm	14.80x3.75
Span length,mm	60
Cross Breaking load,N	202.00
Cross Breaking strength,Mpa	87.4

Following are the Graphs obtained by testing the various composites:

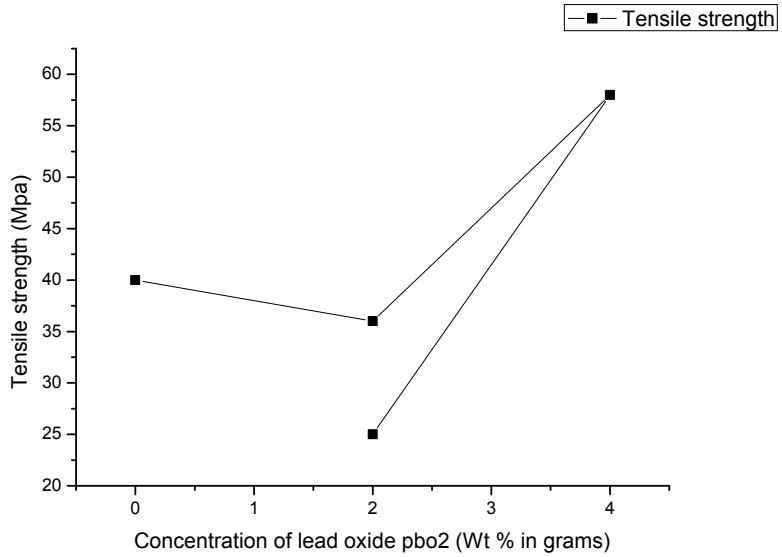
1) **Graph 1**



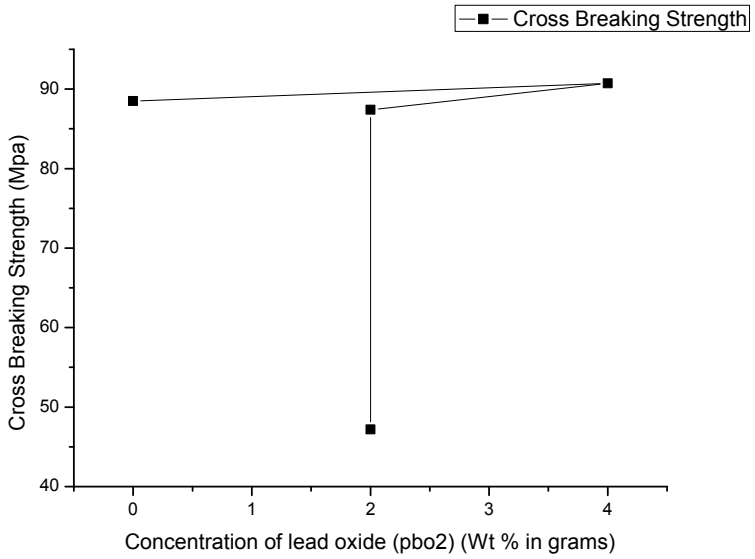
2) **Graph 2**



3) **Graph 3**



2) Graph 4



III. MECHANICAL PROPERTIES

The ultimate tensile strength of the pure epoxy sample was Lesser compared to other sample containing Epoxy with Lead oxide . The 4 % Lead oxide reinforced composite shows 14.5%increase in tensile strength with respect to pure epoxy composite. While the 2% Pbo2 along with 2 % PANI and 2% Wood along with 2% PANI reinforced composites show 9.93% and 52.5% decrease in tensile strength respectively with respect to pure epoxy composite. Thus, it can be concluded that the tensile strength of Lead oxide reinforced epoxy composite increases in its Tensile strength and increases with the further increase in amount of Lead oxide.

The cross breaking strength of the pure epoxy sample was lesser than the Lead oxide matrix composite.

The 4 % Lead oxide reinforced composite shows 1.015% increase in Cross breaking strength with respect to pure epoxy composite. While the 2% Pbo2

along with 2 % PANI and 2% Wood along with 2% PANI reinforced composites show 1.029% and 55.5% decrease in Cross breaking strength respectively with respect to pure epoxy composite.

Table 1. Variation of tensile strength for various composites

Test sample	Tensile strength (MPa)
R1	40
R2	58
R3	36
R4	25
R6	37
R8	21
R3	36

Table 2. Variation of cross breaking strength

Test sample	Cross breaking strength (MPa)
R1	88.5
R2	90.7
R3	87.4
R4	47.2
R6	49.8
R8	50

IV. CONCLUSION

From the above Research work it can be concluded that , higher concentration of Lead oxide enhances mechanical properties such as Tensile strength and Cross breaking strength to the composite. It is the small size of these particles responsible for special characteristics. When we look at future of composites, the advanced composite value in the market share is expected to rise rapidly . Even the aerospace industries working with composite materials is anticipated to grow at elevated rates in comparison to past years. As time progresses, these lighter weight, incredibly strong materials will gain a lot of Importance and dominate the other materials used in almost any given industry .With the increase in demand for these special materials, prices will be forced down, and the technology to make these advanced materials will become more readily available and become very easy.These epoxy polymer composites can be used in real time day to day technological applications.

V. ACKNOWLEDGEMENT

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