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RESEARCH ARTICLE

Effect of Glass Fibers for Acrylic Elastomeric Water Proof Coating

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ABSTRACT

Chopped Glass fibers reinforced acrylic elastomeric composites water proofing compounds and are widely used for various applications .Glass fibers are excellent properties like high strength, stiffness, flexibility, and anti-fracture, insulating material, and resistance to chemical material. All the films exhibited antibacterial activity against E-coli. To prepare elastomeric Acrylic polymer and acrylic with glass fibers the volume fraction (v_0,v_1,v_2,v_3,v_4) (0, 2.34, 4.69,7.10, and 9.43)% , were added chopped glass fibers to acrylic and result solution was stirred by hand for 5 minutes, use the Hand-lay-up technique

Key word: glass fibers- acrylic elastomeric – mechanical properties – color stability - Anti Bacterial activity.

INTRODUCTION

Rubber Began To Be Used As Containers, Growth In Technical Developments And Applications In The 19th Century, Flexible Tubing, Elastic Bands And Waterproofing, Other Technological Advances Included Improved Compounding Techniques Which Enabled The Use Of Anti-Oxidants And Accelerators, And The Incorporation Of Carbon Black To Improve Strength. This Led to a Vast Increase in the Number of Applications, Which Included Seals, Belts, Flooring, Electrical Insulators, springs [1]. Composite Materials Are Considered As One Of The Most Potential Candidates For Aerospace Applications Owing To Their High Strengthto-Weight Ratio And Excellent Fatigue Resistance [2] . The Reinforcement Of Fiber Upon Polymeric Matrix Is Found To Bring About Significant Advancements In Mechanical Behaviors Of Polymeric Host With Added Advantages Of Light Weight, High Strength To Weight Ratio, Excellent Weathering Stabilities And Enhanced Dimensional Stabilities , In Addition To Low Maintenance Cost And Tailor Made Material Behaviors [2]. Glass Fibers Reinforced Polymers (GFRP) Is A Category Of Plastic Composite That Specifically Uses Glass Fiber Materials To Mechanically Improve The Strength And Stiffness Of Plastics, The Resin Provides Additional Protection To The Fiber Due To The Bounding Between Materials [3]. Tear Strength Is A Measure Of The Resistance Of An Elastomer To Tearing. Rubber Hardness Is An Indication Of

Its Rigidity Against Moderate Stress, As Those That Often Has To Bear In Service. The Most Popular Method Of Rubbers Hardness Is The Shore A In Which Is Performed The Measurement With An Instrument Called A Durometer, Based On The Penetration Of A Frusto-Conical Tip Against A Calibrated Metal Spring Reaction [4]. Most Acrylic Elastomeric Roof Coatings Are White Or Near-White In Color. The Whiteness Of The Coating Provides Two Very Important Features. First It Reduces The Temperature Of The Roof Surface And More Importantly To The Membrane To Which It Is Applied [5]. In 1976, The CIE (Commission Internationale De L´Eclairage) Introduced The CIE Color Space ("CIELAB" Or CIE 1976 L*A*B*). The CIELAB Color Space Is Based On Three Dimensional Coordinates With Numerical Values. L* Stands For The Lightness (Brightness) Of The Color, Where Absolute Black Is Given The Numerical Value 0 And White Is 100. The Chromaticity Coordinate A* Describes Redness Vs. Greenness: A High + A* Means Redness While A High - A* Means Greenness. The Chromaticity Coordinate B* Describes Yellowness Vs. Blueness: A High + B Means Yellowness, A High –B* Means Blueness [6]. The membranes for impact resistance. The method utilizes for different mass (gm) of steel balls dropped at various heights onto a roofing system test target. Water Vapor Transmission Rate (WVTR) Is Defined As The Steady Water Vapor Flow In Unit Of Time Through Unit Of Area Of A Body, Normal To Specific Parallel Surfaces, Under Specific Conditions Of Temperature And Humidity At Each Surface. The WVTR Was Calculated From The Steady-State Region Of The Water Losses Time Curves [7].

MATERIALS AND METHODS

Elastomeric material (LAMA Acrylic polymers) white elastomeric roof coating are liquid , tough, hard , and flexible Glass fiber (E-Class) of Surfacing mats composed of continuous glass filaments made of Chennai, india.

Physical Properties

Tear resistance, referencing ASTM D 624, a standard test to determine the tear properties of a cured material test sample to which a specific "cut" has been made to initiate the "tear". Tear is a good descriptor of how well the material might wear under physical demands. Again, because of the low crosslinking, cured gels exhibit very low tear strength [8]. Critical tearing energy (N/m) calculated the equation T c = 2F/ t [9] the F = tearing force and t = thickness.

Hardness test

The hardness of the cured material tested as penetration, Type "A". Penetration, the softest durometer, is tested on a penetrometer. The penetrometer allows a defined foot, or probe, to push into the cured sample at a defined force producing a measurement. Referencing ASTM D 2240, Type "A" durometer is measured by curing a sample at least 0.25" thick and placing it on a test stand with Type "A" indenter. The indenter is forced down into the material at a constant force and a measurement is obtained.

Impact resistance

These test methods cover the determination of the energy that causes plastic film to fail under specified conditions of impact of a free-falling dart. This energy is expressed in terms of the weight (mass) of the missile falling from a specified height which would result in 50 % failure of specimens tested [10]

Brightness and Reflectivity

Most acrylic elastomeric roof coatings are white or near-white in color. The whiteness of the coating provides two very important features. First it reduces the temperature of the roof surface and more importantly to the membrane to which it is applied. This reduced temperature coupled with the UV blocking properties of the coating reduces the rate of degradation and deterioration of the underlying roofing membrane. Second, the white color reflects as much as 95 percent of the heat portion of the sunlight, reducing the heat transferred into the building and thus reducing the air conditioning costs for that building. For most industrial applications, white acrylic elastomeric roof coatings are the perfect choice because most of these buildings have horizontal, or flat, roofs. The high brightness and reflectivity of the coatings is ideal for reflecting the sun's energy back into outer space[5].

Protable Colorimeter

The CIELAB color space is based on three dimensional coordinates with numerical values. L* stands for the lightness (brightness) of the color, where absolute black is given the numerical value 0 and white is 100. The chromaticity coordinate a* describes redness vs. greenness: a high + a* means redness while a high - a* means greenness. The chromaticity coordinate b* describes yellowness vs. blueness: a high + b means yellowness, a high –b* means

Preparation elastomeric and elastomeric with glass fibers composites

To prepare elastomeric Acrylic polymer and acrylic with glass fibers. To prepare the composites fibers with volume fraction (v_0,v_1,v_2,v_3,v_4) (0, 2.34, 4.69,7.10, and 9.43)% , were added chopped glass fibers to acrylic and result solution was stirred by hand for 5 minutes. Hand-lay-up technique was used to cast the samples in the mold plastic. The mixture was left 24 hours to dry. The cutted of samples according the ASTM of physical test.

RESULTS AND DISCUSSION

Tear resistance

Tear strength is defined as the resistance force which a rubber sample, modified by cutting or slitting, offers to the propagation of the tear. A multitude of test specimen configurations have been presented for tear test. The values for the tear strength of elastomeric materials with good tear properties are in the range 50-100 kN/m, and values over 100 kN/m are excellent. Table (1) and Figure (3) tear strength increase with increasing volume fraction of short fibers because the excellent strength of glass fibers [11].

Hardness test

Figure (4) the hardness values increase with increasing glass fibers because the strength of fibers and the bonding (interaction) between the matrix and fibers. The reinforcing fibers of advanced polymer composites are responsible for their high strength and stiffness. However, these can be fulfilled only if sufficient stress transfer from fiber to matrix and vice versa can take place by a proper bonding between the two constituents. This means that physical and to some extent chemical compatibility is required between fiber and matrix. Therefore, the structure and properties of the fiber–matrix interface play a major role in the mechanical and physical properties of composite materials [12].

Impact test

It is the ability of the material to resist the fracture under stress applied at high speed. The specimens are deformed within a short time and therefore exposed to high strain rates. Impact strength increase with increasing volume fraction of glass fibers due to the fibers improved the strength of matrix and good bonding between fibers and matrix figure (5) load values applied the samples when the rupture occurs of samples.

Water absorption

Water absorption is used to determine the amount of water absorbed under specified conditions. Factors affecting water absorption include: type of plastic, additives used, temperature and time Figure (6) water absorption as a function of times when the samples immersed in the water and for a period of time it was observed that the samples absorbed a small quantity of water and increased the amount of absorption with increased fiber ratio and the pure sample got her swollen due to water figure (7). When exposed to water samples of 50 °c , it was observed that the samples were removed from the absorbed water and returned to the first weight and shapes before immersion in water .

Brightness and Protable Colorimeter (color stability)

Most acrylic elastomeric roof coatings are white or near-white in color. The whiteness of the coating provides two very important features. First it reduces the temperature of the roof surface and more importantly to the membrane to which it is applied. This reduced temperature coupled with the UV blocking properties of the coating reduces the rate of degradation and deterioration of the underlying roofing membrane. Second, the white color reflects as much as 95 percent of the heat portion of the sunlight, reducing the heat transferred into the building and thus reducing the air conditioning costs for that building. When added glass fibers increase a little the lightness values (L) (140-142.89) and brightness (229.68-231.24) due to the color stability for composites materials .while a parameter reduced that mean The a parameter describes red/green chroma: a high positive numerical value of a means an intense red chroma and, respectively; a high negative value of a means an intense green chroma. Correspondingly, the b parameter stands for yellow/blue chroma: a high positive b represents yellow chroma and a high negative numerical value represents blue chroma [13]. Shows in table (2)

Anti Bacterial activity

The antibacterial activity of the films shown in table (3) and figure (8) The result showed that the elastomeric films and composites have activity a gainst E-coli. Lama acrylic polymer resist the bacterial type E-coil[14] due to the films good coating water proofing.

CONCLUSION

Excellent waterproofing capability , high strength and stiffness , resist the fracture under stress applied at high speed Elastomeric with excellent dirt pickup resistance which provide long lasting bright color , easy to clean , and resistance to bacterial .

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Table (1) tearing force and tear strength

Samples	Thickness (mm)	Tearing force (mN)	Tear strength(KN/m)
V0	0.8	43306.2	54.132
V1	1	56709	56.709
V2	1.02	65498	64.213
V3	1.01	69810	69.118
V4	1.02	74110	72.656

Table (2) color properties of acrylic elastomeric and composites

Samples	L	a	b	Brightness %
V0	140	-26.21	16.88	229.68
V1	140.82	-27.00	18.21	230.64
V2	141.1	27.23	18.43	230.87
V3	142.23	-27.89	19.13	231
V4	142.89	-27.9	19.00	231.24

Table (3) Antibacterial activity as the inhibition zone diameter (mm) of elastomeric film and composites

Samples	Inhibition zone (mm) E.coli
V0	8
V1	12
V2	15
V3	16
V4	16

Figure (1) samples immersion in water

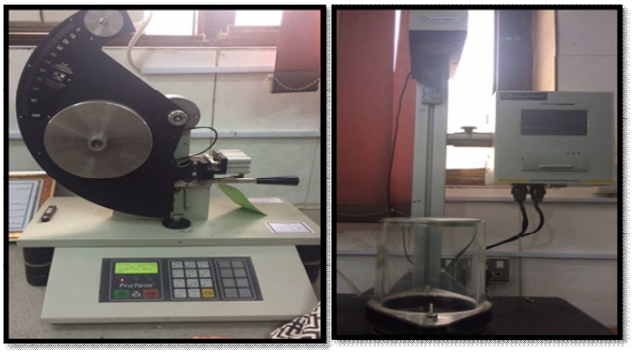

Figure (2) tear test and impact test for Elastomeric films Samples

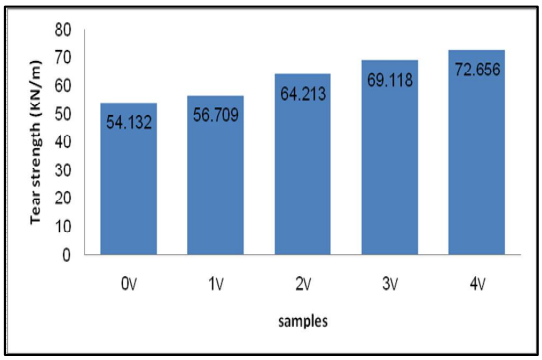

Figure (3) Tear strength as a function of samples

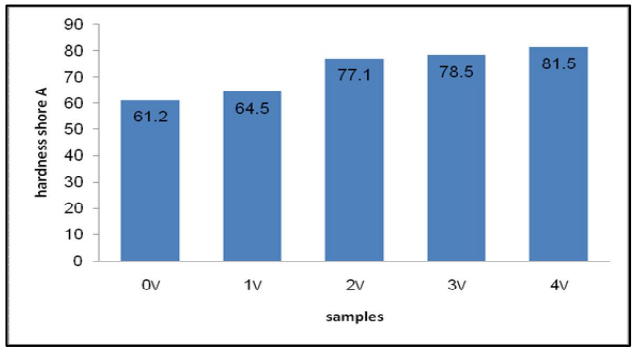

Figure (4) hardness values as a function of samples

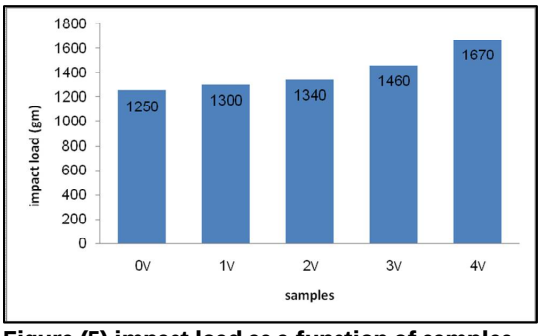

Figure (5) impact load as a function of samples

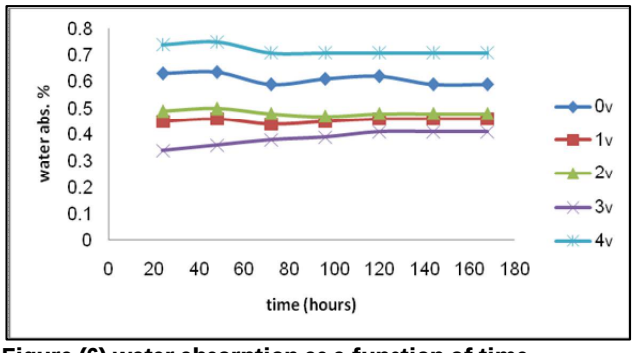

Figure (6) water absorption as a function of time

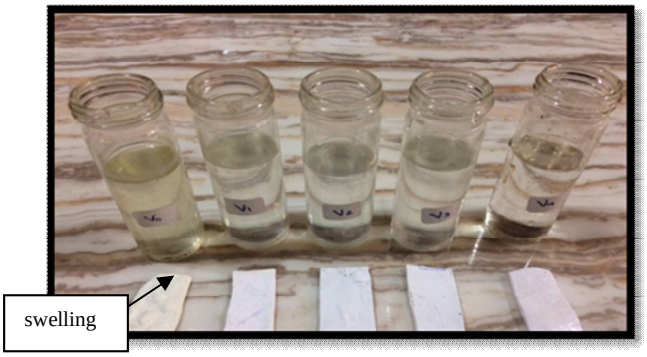

Figure (7a) samples after immersion water

Figure (7b) samples after drying 50 °C

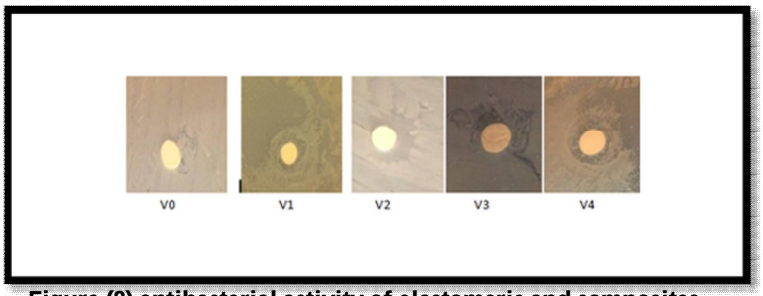

Figure (8) antibacterial activity of elastomeric and composites