



STUDY ON PHENOLIC FORMALDEHYDE FABRIC SHEET PRODUCTION AND OUTCOME QUALITY FOR MECHANICAL CHARACTERISTIC

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Abstract —Hylam sheet, It is and thermosetting resin material with its unique property of not getting reacted with waters and hard chemicals due to its unique property of to withstand high voltage and insulation it's even a bad conductor of heat and hai physical strength in industrial uses it's being increased we have gone through number of a changes in which the properties of a material by just making minor change temperature and pressure we got some best resorts in a change in its properties like strength and electrical resistivity.

Keywords-phenolic resins, cotton fabric 150 gsm, formaldehyde, temperature and pressure

I. INTRODUCTION

Generally all the material has its unique property but its properties get changed while changing its temperature but in composite materials like phenolic fabric sheet it has very unique property by manufacturer the sheet we can change its property by just getting change in temperature and pressure highlander bricks it is generally available in 0.1 mm 20. 150 mm thickness and more but its industrial uses is not has a public aware and the usage of other polymer material like plastics and nylon is there in pharmaceuticals and textile industries the material uses very much known but another sector still its needs to be aware it is not able to replace wood and plastic do it has a unique property has come back to wood and plastic but still it need to be promoted in market like wood might get burn at high temperature and due to moisture absorption it might get layer but such circumstances won't affect the Highland fabric sheet has some even plastic get Centre emanated if temperature increases anyone get melted the material like cast metals are galvanised get affected by master and blessed and get rusted due to its heavyweight it increases the machine weight Helen publish it is unit material while it's good property of plastic foods and matter in it has flexibility like plastic insulation more equal than wood and good strength has liked casting.

II. COMPUTATIONAL MODEL AND ANALYSIS

Composites

Composite materials are being widely taken into industrial and commercial usage in recent time for day to day applications and at the same time they had wide role in manufacturing of sophisticated machines and equipment also. Composite materials has many advantages over today's demand such as light weight, simple and cheap manufacturing process and also have comparable properties of their constituent materials . So the main task for my research was to improve the properties of composite materials according to the application and make them more durable, high strength, weight efficient and cost effective.as Composite bake lite material shows advantages like low weight, low density, low cost and good specific properties like tensile, flexural and impact strengths. It can be taken into consideration in area where weight of the total equipment is a major problem, like space rocket technology, aircraft industry, marine structures etc. By combining with some cotton fabric material, composites can also utilized as thermal and electrical insulating material. Composites are used to prepare many mechanical components like brake, machine parts, insulating block, textile block etc.

Composition of formaldehyde, phenol, urea. and methanol (at some proportion)

Usually fabric and paper is taken in layering the sheet by emerging it into the resin of phenolic formaldehyde composition

The high quality Paper Based Hylam Bakelite Sheets are widely used in Electrical and Automobile industries because of their extra-ordinarily high resistance against electricity, heat, chemical action and mechanical strength. Hylam Bakelite Sheets are made from high quality raw materials that are highly in demand for their dimensional accuracy, mechanical strength, heat resistance and low absorption of water. Bakelite Sheet is well known for its usage in electrical and textile industries.



Figure 1 Hylam fabric sheet

Phenolic

Bakelite resins are available in granules, powders or liquids. The various physical forms supplied make possible the mixing with many types of reinforcing agents. These phenolic formaldehyde resins allow for the design of products with high strength to weight ratio combined with outstanding electrical, heat and chemical resistance. These properties, together with the excellent adhesive qualities, account for their successful use in many industries and commercial applications. Bonding and laminating varnishes in the production of industrial and decorative laminations. Phenolic formaldehyde material resin is capable of absorption of fabric material and binds with the material in an excellent way. For use as the binder and curing ingredient in phenolic thermosetting material.

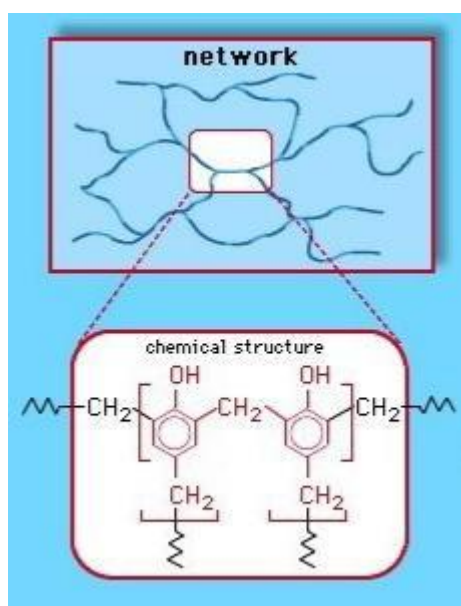


Figure 2 molecular structure of material

These are Phenolic Resin impregnated Paper Base Sheets manufactured specially as per SpecI S2036 for Electrical Insulation. These sheets have volume resistivity of 108-1010Ωcm, with stable antistatic property. The anti-static properties remains unchanged even after machining process is carried out on material. They have operating temperature is -20°C-100°C These sheets have excellent processing performance. this material is asbestos free and can be easily machined as sawn and drilled. These sheets have got good electrical properties and can even be used in PCB, Switch board panel, domestic meter boards and as shields.

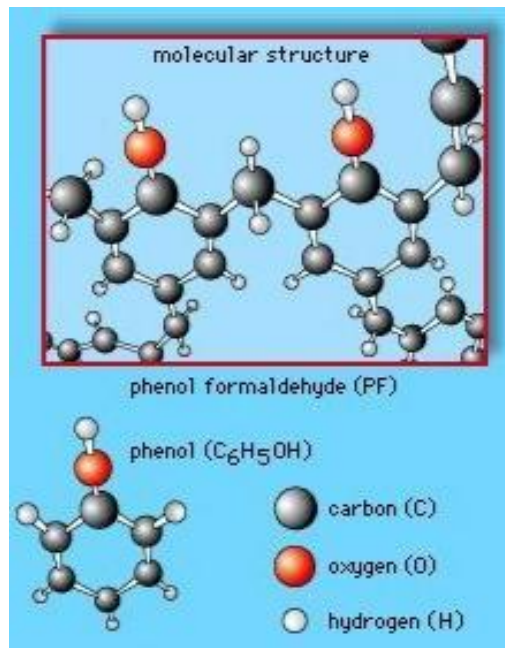


Figure 3 molecular structure of phenol formaldehyde

Cotton fabric

Cotton fabric (200-250 GSM) is used to blend the phenolic fabric resins in it by dipping its in more than 5 minute slowly and by conveyor its directly transferred to dry chamber where it is fully coated and absorbed as the reason for using cotton fabric other than polyster or linen is good absorption properties of cotton and due its criss cross pattern it make more convient to coat resin in it and even other fiber get burned and shrink

Temperature and pressure

By heating it under **pressure**, at about 150 °C (300 °F), Bakelite resin was able to suppress the foaming that would otherwise occur. The resulting substance is extremely hard when solidified and both insoluble and infusible.

Heat capacity (C): 0.92 kJ/(kg·K)

Chemical formula: (C₆H₆O·CH₂OH)_n

Density: 1.3 g/cm³

Molar mass: Variable

By the maintaining precise accuracy in mixture of materials(composites),its viscosity,thickness,absorptionability ,temperature and pressure plays main role in manufacturing process as below shown gives exact idea of proportionality need to be maintain in manufacturing the hylam fabric sheet its does get vary with different material(glassfabric,paper and other fabric).

COMPOSITIONS MATERIAL	APPROX PROPORTION
FIBER CLOTH	200-250 GSM
RESIN CONTAIN	50 % OF WHOLE FABRIC
RESIN MIXTURE	40-60 PROPORTION
UREA	10 LITER PER 1 TON
METHANOL	20 LITER PER 1 TON
CATALYST (HCL/H2SO4 UPTO 10% CONCENTRATE)	10%-15% OF WHOLE BATCH IS ADDED AS PER REQUIREMENT IN PROCESS, AS IT DOES EFFECT PROPERTIES WITH DIFFER IN CATALYST
COATING	50% FABRIC AND 50% RESIN

Table 1 Compostional ratio of hylam fabric sheet

III. EXPERIMENTAL WORK

Usually the composition of resins is different in all industries it is being manufactured as per the customer requirement and industrial usage even paper and fabric composite sheet have different proportions to be maintained and temperature difference is being experimented to reduce defects and increase its ductility and strength. As shown in the above table, it gives a clear view that the same composite material is heated and pressed at different temperatures and pressures and what kind of changes we get inside the material formed and what kind of defects are formed and can be eliminated by making minor changes in temperature and pressure without making any changes in the composition of material.

THICKNESS	DIPPING TIME	DRYER TIME	HEATING IN PRESS*	PRESSURE IN PRESS*
8 MM	5 SEC	125 C	T1 150	160 POUND
8 MM	5 SEC	125 C	T1 150	170 POUND
8 MM	5 SEC	125 C	T1 125	180 POUND
8 MM	5 SEC	125 C	T1 180	180 POUND
8 MM	5 SEC	125 C	T1 200	180 POUND

Table 2 Experimental setup

Above shown table gives the sets of information required to find out exact variation in physical properties of the hylam sheet manufactured as per above mentioned charts, in that every material is being tested as per the industrial requirement (in the best touch industries) from that by just minor decreasing or increasing in temperature and pressure in the manufacturing process it gave tremendous changes in the properties of hylam sheet.

IV RESULT AND DISCUSSION

The hylam material gets its strength when adequate temperature and pressure is applied on it, when high pressure is imposed it might get its bending properties lost and even loses its actual required thickness. So that to maintain its strength and maintain its required properties proper temperature of 120 C to 150 C temperature is applied.

The physical properties of material are being taken into consideration after making changes in temperature and pressure, what kind of changes we get in its properties results which are being mentioned as below.

Standard units as per S.I Unit

P1- properties as per International Standard.

P2- properties results as per China Standard.

P3- properties changes after temperature and pressure changes(120 degree centigrate and 150 pound pressure).

Properties	Units	P1	P2	P3
Tensile strength(min)	Kgf/cm2	550	580	650
Flexural strength(min)	Kgf/cm2	860	1340	1340
Shear strength(min)	Kgf/cm2	620	715	715
Impact strength(min)	Kgf/cm2	2	3.05	3.05
Compression strength(min)	Kgf/cm2	860	860	860
Electrical strength(voltage)	Kv	15	15	15
Flatwise (For 1.6mm Thickness) Edgewise	Kv	20	15	15
Insulation Resisitance(min)	MW	1000	1000	1000
Water absorption of 1.6mm	mg	35	33	32
Thickness(Range)available	MM	0.8 to 50.0	0.8 to 50.0	0.8 to 50.0
Punchability (maximum thickness limit)	MM	Hot 2.5mm	Hot 2.5mm	Hot 2.5mm

Table 3 Technical properties and Specification

The above given data is being collected from the companies who manufacture hylam bakelite sheet and is being compared by the material which is being manufactured as per experiment and the best result of hylam sheet(120 c temperature and 150 pound pressure) is taken into consideration for the laboratory test to fullfill industrial requirement.

The reason for not taking all the other sheet of different temperature and pressure due to its no requirement in industries

V. CONCLUSION

- Due to changes in temperature and pressure of the composite material we get better changes in material properties.
- Material stength get increased and even manufacturing process time is even get reduced
- Material physical properties and quality of resins causes difference in material colours ,As we change the viscosity of material its density also get differ .

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