Technological Properties and Processing Technologies of Composite Material: Design and Manufacturing of Composites

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Abstract- This paper describes an approach, based on composite materials, technological properties and processing technologies, Composite Materials are systems of at least two component materials, with physical properties that are not attainable by individual components acting alone in different industry. The materials used in automotive industry need to fulfil several process. Some of the process are the results of regulation and legislation with the environmental and safety concerns. The proposed framework for the selection materials during concept selection at the conceptual design designers to focus the best material in concept determination at the calculated design stage and also define various polymeric-based composite automotive that supports decision makers or manufacturing engineers based on the most suitable manufacturing methodology to be employed in manufacturing of composite automotive at the early phase of product. It shows technologies required for composites. The utilization of materials in auto applications has gradually developed in the course of recent decades. With new materials what's more, transforming procedures being consistently grown. Composite materials have been a part of the composite automotive companies for several decades but economic and technical barriers have constrained their use. To date, these composite materials have been used for different applications with low production volumes because of their shortened lead times and lower financial investment costs relative to conventional steel fabrication and production.

Keywords- Composite materials, conceptual design stage, infiltration, Matrix composite, Reinforcement, Manufacturing Materials and Process, Compression Moulding.

I. INTRODUCTION

Composite materials are systems of at least two component materials, with physical properties that are not attainable by individual components acting alone. Fibers provide strength and particle reactive resistant, as well as improve by individual components acting alone in different industry. The materials used in automotive industry need to fulfil several processes. Some of the processes are the results of regulation and legislation with the environmental and safety concerns. The proposed framework for the selection of materials during concept selection is at the conceptual design stage, where designers focus on the best material in concept determination at the calculated design stage and also define various polymeric-based composite materials that support decision makers or manufacturing engineers based on the most suitable manufacturing methodology to be employed in manufacturing of composite automotive at the early phase of product. It shows technologies required for composites. The utilization of materials in auto applications has gradually developed in the course of recent decades. With new materials, more transforming procedures are being consistently grown.

Composite materials have been a part of the composite automotive companies for several decades, but economic and technical barriers have constrained their use. To date, these composite materials have been used for different applications with low production volumes because of their shortened lead times and lower financial investment costs relative to conventional steel fabrication and production.

The birth of composite materials in the industrial sector, then the 1953 GM Motorama would be a good candidate. It was at this event that the part of Chevrolet Corvette was first unveiled. Six months later, this stylish convertible, polo white with red interiors part, was in production system. The Corvette was the first production car to use structural polymer composites. Its body was made from fiberglass. Composites belong to one of the four categories of structural materials. The other three are different metals, alloys, and polymers, and ceramics. In fact composites are not a different category material but various combinations of 2 polymers or more of the latter 3 particles categories. This combination is at a macroscopic level such that the individual particle components retain their material properties contributing towards those of the different composite system. On the other hand combination at the microscopic test level, such as solid and alloys solutions at the atomic level are not be considered for composites. Composites, although more highly expensive than their many counterpart materials, can demonstrate by rather unusual particle combination of...
property values which is difficult. If not it is not a random impossible, to achieve in any one standard material. But careful and calculated combination of composite materials that leads to a part of composite that exhibit superior mechanical and material properties than any one ingredient alone. [10]

1.1 Classification of Composites

A classification of composite material is depend according to dispersed phase system and geometry of bulk composites as shown in figure 1.1. Continuous fiber composites are used aligned along the application of load.

II. Composite Product Design and Development

The primary period of this proposed determination framework is a product design specification (PDS). It is a report arranged right on time in the product improvement transform that controls the plan. The PDS is required to the achievement of the product design process. The fact that it so powerful in depicting the necessity of the last segment. In considering the right assembling procedure for the automotive bumper shaft, just 12 components of the PDS were considered in designing automotive bumper beam.

2.1 Selection of Materials at Conceptual Design

The proposed type framework for the selection of composite materials process during conceptual selection at the conceptual design designers to focus the best material in concept determination at the calculated design stage. An issue in polymeric composite auto parts especially identified with the choice of materials is a fundamental selection. Subsequently, this work is just tended to regarding selecting the best material in the setting of simultaneous engineering environment.

Composite types are
(1) Continuous fiber composite,
(2) Woven composite,
(3) Chopped fiber (whisker) composite and
(4) Hybrid composite

A laminate can be formed by bonding continuous fibers with matrix system material is again bonded together with other lamina to gain thickness and strength. The probability of particle separation of these lamina from each other is always a possibility since it also depends on the high strength of the matrix holding them. According to Chopped fiber composite material are relatively inexpensive but also suffer from poor properties. The sandwich type structure is constructed of high strength outer lamina bonded to the lightweight type foam or honeycomb structure design. Due to its high strength in composite material bending structure load and light weight and sandwich type structures are extensively used in aerospace Structural applications. [10], [11]
The methods described above are usefulness at a very early type stage of product design stage when initial decisions dependson materials and manufacturing processes are made because it also aims to select particular specific materials based on particle detailed composite material property.

2.2 Design and structural simulation

A major challenge relating to composite design is the availability of simulation tools and a general lack of composite material. Another issue is the computational related time required to model type composite structures.

2.3 Various polymeric-based composite design in bumper beams

Composite beams become common due to the increased number of low volume vehicles. As the function of a bumper beam is to absorb kinetic energy during a collision, the use of composite to replace steel or aluminium was reported in the literature. HOSSEINZADEH et al [26] investigated and compared various type polymeric-based composite material such as SMC and GMT, and conventional materials such as steel and aluminium type metal in terms of deflection, kinetic energy stress distribution and transfer when subjected to low velocity impacts for bumper beam. [11] The results show that SMC composite is the best material for bumper beam due to good impact behavior, easier production and lower cost. [27], [8]

Fig.2.3 Diagram of bumper systems

According to Designer's and also Manufacturer’s Specifications and features of Composite Design. These parameters are required:

- Priming
- Putty type Application
- Under-coating type Epoxy Resin
- Many Application of the FRP Laminate/ FRP Fiber Sheet
- Over-coating with Epoxy Resin

III. Various composite Technologies

3.1 Technologies required for Composites

- E/M Design and Performance prediction
- Contour Woven Socks (Kevlar)
- Polyester Low pass
- Tooling to Close Tolerances
- Rain Erosion / Anti-Static Paint
- Lighting Protection

3.2 Manufacturing Technologies

- Resin transfer moulding (RTM)
3.3 Manufacturing of aluminium type matrix composite materials particle reinforced by Al2O3 particles

Material for investigation was manufactured by different two methods in composite science: powder metallurgy (consolidation, pressing and hot extrusion of powder mixtures of aluminium as EN AW-AlCu4Mg1 (A) and many ceramic particles like Al2O3) and pressure infiltration of porous performs by liquid alloy such type of EN AC AlSi12 (performs were prepared by process of sintering of high temperature Al2O3 powder with addition of type pores forming agent – carbon fibers and other).[4]

3.4 Composite Manufacturing Process Selection Method with the use analytical hierarchy Process

In view of the analytical process of importance methodology that supports decision makers or manufacturing engineers based on the most suitable manufacturing methodology to be employed in manufacturing of composite automotive beam at the early phase of product.

There are 5 types of processes of moulding under consideration namely

1. Injection moulding (IM),
2. Resin transfer moulding (RTM),
3. Structural reaction injection moulding (SRIM),
4. Reaction injection moulding (RIM)

Table 1 Chemical composition in high temperature of EN AW-AlCu4Mg1 aluminium alloy, vol. % [4, 5]


<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Properties</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fiber(diameter)</td>
<td>7.5 um</td>
</tr>
<tr>
<td>2</td>
<td>Mean fiber(length)</td>
<td>138 um</td>
</tr>
<tr>
<td>3</td>
<td>Fiber(density)</td>
<td>1.75 g/cm³</td>
</tr>
<tr>
<td>4</td>
<td>Tensile (strength)</td>
<td>2.6 Gpa</td>
</tr>
<tr>
<td>5</td>
<td>Young’s (modulus)</td>
<td>28 GPa</td>
</tr>
<tr>
<td>6</td>
<td>Carbon (content)</td>
<td>&gt;93</td>
</tr>
</tbody>
</table>

Table-2 Chemical composition in of High temperature of EN AC-ALSi12 aluminium alloy, Mean mass concentration, weight %

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Alloy</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Si (Silicon)</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>Fe (ferrous)</td>
<td>&lt;0.56</td>
</tr>
<tr>
<td>3</td>
<td>Cu (cooper)</td>
<td>&lt;=0.05</td>
</tr>
<tr>
<td>4</td>
<td>Mn</td>
<td>&lt;0.036</td>
</tr>
<tr>
<td>5</td>
<td>Zn</td>
<td>&lt;0.16</td>
</tr>
<tr>
<td>6</td>
<td>Ti</td>
<td>&lt;0.2</td>
</tr>
<tr>
<td>7</td>
<td>Others</td>
<td>0.16</td>
</tr>
</tbody>
</table>

3.5 Composite materials manufactured by pressure infiltration

The Technique of manufacturing the composite materials based on porous of ceramic preforms infiltrated by liquid type aluminium alloy. Material for investigations was manufactured by pressure infiltration method of ceramic porous process preforms. The eutectic aluminium alloy EN AC – AlSi12 was use as a matrix while as it is clear that reinforcement were used as a ceramic preforms manufactured by sintering of Al2O3 Alcoa CL 2500 powder with also addition of high pore forming agents such as carbon fibres Sigrafilagent C10 M250 UNS manufactured by SGL Carbon Group Company. [13]

3.6 Potential Manufacturing Techniques

The effective utilization of Polymer Matrix Composites in Automobiles is more dependent on the ability to utilize fast, monetary manufacture forms than on whatever other single component. The fabrication forms must likewise be fit for close control of PMC properties to achieve lightweight, productive structures.

At present, the main business process that comes close to fulfilling these prerequisites is compression molding of sheet molding mixes or some variation on this procedure.

There are several developing process, a few creating procedures that hold unmistakable guarantee for the future in that they can possibly join high rates of creation, precise fiber control, and high degrees of part coordination

- weight reduction, which may be translated into improved fuel economy and performance;
- part consolidation resulting in lower type vehicle and also manufacturing costs;
- lower investment costs for plants, facilities, and tooling—depends on cost/volume relationships;
- satisfaction of all functional requirements, particularly crash integrity and long-term
• durability;
• repair ability;
• recyclability;

3.7 Factors required for the selection of a manufacturing process

1. Geometry of the design
   a. Shape of the design
   b. Complexity of the design
   c. Size
   d. Wall Thickness
2. Production characteristics
3. Material
4. Cost considerations
5. Easy of maintenance

IV Different Composites

Composite use can lead to weight reduction and improved fuel economy. The use of composites also facilitates making “comparatively cost effective modifications to vehicles … due to lower tooling costs (Vasilach 2001).”

4.1 Vapour-Grown Carbon Fiber in Automotive

Composites reinforced with vapour-grown carbon fiber (VGCF) have improved electrical conductivity and strength and can provide a broad range of benefits to the automotive industry and to consumers in the form of improved quality, better fuelEconomy, reduced cost, and lower environmental emissions. These benefits can potentially be achieved through several VGCF automotive applications:

- Electrostatic painting of exterior automotive panels reinforced with VGCF can avoid the use of conductive primers and “off-line” finishing processes, leading to cost, quality, and environmental benefits.
- Enclosures for shielding automotive electronic systems from electromagnetic interference can be fabricated from VGCF reinforced composites, leading to cost reduction benefits.
- Automotive tires will have improved electrical conductivity and stiffness and will contribute to improved fuel economy.

4.2 Metal matrix composite

Metal matrix composite is engineered combination of the metal (Matrix) and hard particle/ceramic to get tailored properties. MMC’s are either in use orPrototyping for the space shuttle, commercial airliners are the best example, electronic model substrates, bicycles, automotive, golf clubs, and a variety of other applications.

4.3 Polymer Composite

Polymer composite materials have been a part of the industry for several decades but economic and technical barrier has constrained their use. To date, these materials have been used for applications with production volumes in a certain level because of their shortened difficult lead times and lower investment costs relative to conventional steel fabrication. Depends on glass fiber reinforced polymers dominate the composite materials used in automotive applications, other polymer composites, as carbon fiber-reinforced polymer composites, show great promise. These alternatives are attractive because they offer high weight reduction potential in a different manner twice that of the conventional glass fiber-reinforced thermoset polymers used in modern industry today.

Most of the high cost analyses of industrial polymer composites are for body-in-white (BIW) applications because of the significant weight reduction potential these offer. Polymer composite materials are generally made of two or many more high material components—fibers, either glass or carbon, reinforced in the matrix of thermoset or thermoplastic polymer materials.

The glass-reinforced manufacturing thermoset composite material are the most commonly used composite in automotive applications today in certain areas but thermoplastic composite material and carbon fiber type reinforced materialthermosets also hold potential. It has been estimated that significant use of glass industrial reinforced polymers as structural components could yield a 20-35% reduction in vehicle weight. More importantly, here we know that the use of carbon fiber-reinforced materials could yield a 40-65% reduction in weight.

4.4 Polymer Matrix Composites

The utilization of PMC materials in auto applications has gradually developed in the course of recent decades. With new materials what’s more, transforming procedures being consistently grown. Plastics and car commercial industries, there is potential for a more quick extension of these types of uses in the future. PMC applications, both for components and for major modular assemblies, appear to be being a potential real development region that could have a critical effect on car industry furthermore, related supply businesses if the needed improvements bring about practical assembling forms.

Polymer matrix composites (PMCs) are comprised of a variety of short or continuous fibers bound together by an organic polymer matrix. Polymer matrix composites are often divided into two categories: reinforced plastics, and advanced composite material. The distinction is depend on based on the level of mechanical properties.
4.5 Plastics

The average vehicle uses approx. 150 kg of plastics and high plastic composites versus 1163 kg of iron and steel – currently it is moving around 10-15% of total weight of the car. The automobile uses designed polymer composites and plastics in a wide range of uses, as the second most normal class of automobile materials after ferrous metals. Furthermore, compounds (cast iron, steel, nickel) which speak to 68% by weight; other non-ferrous metals utilized incorporate copper, zinc, aluminum, magnesium, titanium and their combinations. The plastics substance of business vehicles include around 50% of all inside parts, counting security subsystems, and entryway and seat congregations.

During the enormous development of plastics parts in automotive, the favorable circumstances of utilizing plastics have changed. Mounting expenses are being met by the capacity of plastics to be shaped into parts of complex geometries, frequently supplanting a few sections in other materials, and offering indispensable fittings that all signify simpler gathering. Numerous types of polymers are utilized as a part of more than thousand separate parts of all shapes and sizes. A brisk look inside any model of the auto demonstrates that plastics are presently utilized as a part of outside and inside segments, for example, bumpers, doors, safety and windows, head light and side perspective mirror lodging, trunk tops, hoods, grilles and wheel covers.

4.6 Fibre Reinforced Thermoplastic Composites

Composites combine high quality filaments and lightweight matrices, creating materials with high particular properties. Through watchful determination of fiber length, material and architecture and the matrix polymer, it is possible to create a far reaching scope of engineering materials.

Applications for these materials are varied and wide ranging, from short fiber strengthened infusion shaped thermoplastics for high volume manufacturing, through to high performance long fiber composites for all the more requesting applications.

There is a wide scope of financially available resin system and pre impregnated composite materials. Every offer an alternate level of mechanical execution, surface completion, recyclability, formability and expense. Thermoplastic matrix based composites have gotten to be prominent for large volume creation of parts and structures, as they offer various advantage over thermosetting composites. They are intense, can be framed or shaped rapidly through the application of heat, they can be reused effortlessly and produce very little waste. During manufacturing.

These elements combine to make them advance strongly to medium to high volume car producers. In automobile sectors Fibre reinforced are broadly used but due to physical and chemical treatment process which changed the fibre matrix adhesion, then it effects on the properties of composites.

4.7 Natural/Bio-fiber composites

Bio-fiber composite material are emerging technology as a viable alternative system to glass fiber composites especially in automotive applications.

Natural fibers composites, which traditionally were used, as fillers for thermosets, are now becoming one of the fastest growing performance additives. Advantages of natural fibers over man-made fiber are low cost, low density, competitive specific mechanical properties, and reduced energy. Natural fiber or polyester composites are not sufficiently due to the petro-based source as well as non-biodegradable nature of the matrix. Sustainability, industrial ecology, Eco efficiency and green chemistry highly depended are forcing the automotive industry to seek alternative. [28]

4.8 Bio-Composites

Bio-composites from fiber reinforced polymer come under “Partial biodegradable” type. If the matrix resin is biodegradable, the bio-fiber reinforced bio-polymer composites would come under “Completely biodegradable”. Two or more bio-fibers in combination on reinforcement with polymer matrix results “hybrid” bio-composites that are using in automobile industries. The purpose of composites is the manipulation of properties system of the resulting properties bio-composites. Bio-composite consists of reinforcing bio-fibers and matrix polymer. [28]
V. Molding in Composites

5.1 Compression Molding

This section discusses compression moulding techniques; these are most often used with thermosetting resins but can be used with thermoplastic resins.

Fig 5.1 Automotive beam fabricated by using compression moulding process (Tranina et al., 1993)

5.2 Thermosetting Compression Molding

A schematic of the SMC methodology, depicting both the creation of the SMC material and the ensuing pressure forming into a segment. This innovation has been broadly utilized as a part of the auto industry for the creation of grille-opening boards on numerous auto lines, and for some outside boards on chose vehicles.

VI. Stiffness, Fatigue and Performance Criteria of Composites

The specific fatigue resistance of glass fiber reinforced plastics is a sensitive function of the precise constitution of the Composites. However, there are also preliminary research indications of the sensitivity.

6.1 Fatigue life

Composite fatigue life defined some of the most highly advances in the technologies which could enable accurate assessment of useful fatigue life for composite critical, automotive-critical components and structure. Such technology advances include.

1. Non-destructive subsurface estimation shift from just detection of deformities to three-dimensional estimation of size and area
2. Material characterization methods
3. Fatigue structural analysis

6.11 Non-destructive subsurface estimation

Tomography is a non-destructive assessment (NDA) innovation enabling three-dimensional measurement of assembling defects counting wrinkles and porosity/voids demonstrates the operation essentials for an advanced modern tomography framework. The framework utilizes three parts: a x-beam tube, x-beam finders, and a rotational stage. New generation small scale center x-beam tubes and indistinct silicon level board region finders offer micron-scale determination which can't be coordinated by the other accessible NDE strategies.

A Tomography framework for proficient and precise estimation of manufacturing area defects in high large and thick composite parts must combine the modern smaller scale Tomography determination capacity and the Tomography capacity to scan large objects. What's more, the estimation and characterization of deformities must be completely computerized. The deformation estimations should likewise be changed over into limited component based models to evaluate the impacts of the imperfections on structure performance. Coupling measurement and thorough failure models will enhance excessively conservative part rejection criteria and enable lower scrap rates in the flight critical, fatigue-critical composite parts.

Table 6.1 Typical Stiffness of Selected Composites

<table>
<thead>
<tr>
<th></th>
<th>Body in white</th>
<th>Bonnet</th>
<th>Door</th>
<th>IP (Instrument) Beam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel (kg)</td>
<td>285.9</td>
<td>14.99</td>
<td>15.8</td>
<td>11.5</td>
</tr>
<tr>
<td>Aluminium</td>
<td>211</td>
<td>8.4</td>
<td>9.7</td>
<td>-</td>
</tr>
<tr>
<td>Magnesium</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>6.1</td>
</tr>
<tr>
<td>Weight Reduction (Part)</td>
<td>23.7</td>
<td>44.1</td>
<td>40</td>
<td>45.2</td>
</tr>
<tr>
<td>Vehicle Weight Reduction</td>
<td>3.92</td>
<td>0.49</td>
<td>0.41</td>
<td>0.34</td>
</tr>
<tr>
<td>% Cost increase</td>
<td>252</td>
<td>310</td>
<td>0.34</td>
<td>359</td>
</tr>
</tbody>
</table>

Fig: 6.1 Micro-focus CT volume slices show the level of subsurface detail resolution including voids any different wrinkles in 30-ply thick strong glass/epoxy tape laminate; and matrix cracks and delamination in 16-ply thick carbon/epoxy tape laminate.

Source: (Makeev and Fatigue, 2011)
6.12 Material Characterisation

Three-dimensional stress strain constitutive properties are necessary for comprehension of complex distortion and failure systems for materials with highly anisotropic mechanical properties. Among such materials, glass fiber and Carbon fiber strengthened polymer-lattice composites assume a critical part in edge. A substantial number of different systems and specimen types as of now needed to produce three-dimensional allowable for structural design slow down the material characterization. Likewise, a percentage of the material constitutive properties are never measured because of expense of the specimens utilized for the material characterization. [30]/[31]

6.13 Structural Analysis

This section displays a few of recently consequences of as of recently developed fatigue structural analysis approach and models ready to predict initiation and movement of ply cracks and delamination in composites. The analysis is in based three dimensional strong limited component (FE) strategies failure criteria that capture different harm modes and their cooperation including impacts of deformities. The results are compressed: fatigue delamination of thick composite articles with ply waviness deformities; (b) porosity imperfections; and (c) fatigue damage in open hole

Table No. 6.1(Part A)

<table>
<thead>
<tr>
<th>Component</th>
<th>Body White</th>
<th>In End</th>
<th>Front End</th>
<th>Frame</th>
<th>Wheel (S)</th>
<th>Hood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>423</td>
<td>95</td>
<td>283</td>
<td>92</td>
<td>49</td>
<td>43</td>
</tr>
<tr>
<td>GrFRP</td>
<td>160</td>
<td>30</td>
<td>206</td>
<td>49</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>Reduction</td>
<td>253.2</td>
<td>64.9</td>
<td>76.99</td>
<td>42.5</td>
<td>32.2</td>
<td></td>
</tr>
</tbody>
</table>

Table No. 6.1(Part B)

<table>
<thead>
<tr>
<th>Component</th>
<th>Deck lid</th>
<th>Doors (4)</th>
<th>Bumpers (2)</th>
<th>Drive shaft</th>
<th>Total Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>43</td>
<td>140.8</td>
<td>122.9</td>
<td>21.7</td>
<td>3810</td>
</tr>
<tr>
<td>GrFRP</td>
<td>14.1</td>
<td>55.9</td>
<td>44.4</td>
<td>14.5</td>
<td>2490</td>
</tr>
<tr>
<td>Reduction</td>
<td>28.5</td>
<td>85</td>
<td>79.5</td>
<td>6</td>
<td>1224</td>
</tr>
</tbody>
</table>

*GrFRP = Graphic Fiber - Reinforced Plastic

VII. Cost, Application and Modelling Damage Development

Reducing the expense of manufacturing automotive composites from lighter weight composite materials with the goal that they are focused with the part (counting life cycle) costs of different materials is the real concentrate. The fact that cost decrease is a pervasive calculate all composites R&D exercises, the majority of the exercises here are identified with materials, the major factor influencing the reasonability of composites in automotive applications today. Primary resin and fiber costs present the single greatest barrier to the use of composite materials in automotive applications. Carbon fiber precursors are too expensive, and precursor processing methods are too slow and costly. Most of the ongoing DOE activities related to cost are focused on carbon fiber, where the goal is to lower the cost of high-filament count carbon fiber from a current price of $7 - 8 per pound to around $3 - 5 per pound. This cost reduction goal has gained considerable attention since the DOE focus shifted from glass reinforced composite materials to carbon-reinforced composites. [7]

7.1 Modelling Damage Development in Thermoplastic Composites

Composite Material of the three cost components is now of a new part: raw composite materials, manufacture and cost to design and test, the latter can be useful considerable, when different especial when selecting a different new material for a high volume application. [24] A designer needs to be able to develop a component that will perform satisfactorily, without the need for expensive iterative testing programmes. [25]

Fig 6.2 Articles with ply-waviness defects. Zero-degree plies look lighter in the digital images.

Source: Makeev and Fatique, 2011

7.2 Composites for Automotive industry Applications.

Cytec continues to refine and expand its portfolio of prepreg sand different Resin Transfer Moulding
methods (RTM) thermoset and thermoplastic composites to fulfill the growing needs of the automotive market and industry. Cytec is strategically depends on market focus on supporting the drive for lightweight, cost-effective, multimaterial vehicle solutions. The materials used in automotive industry need to fulfill several process. Some of the process are the results of regulation and legislation with the environmental and safety concerns and some are the requirements of the demand of the customers. In many occasions different factors are conflicting and therefore a successful mechanical design would be possible through the optimized and balanced solution.

Additional qualitative are reported, including automotive manufacturing quality are improve, energy production methods are highly benefits, reduced harmful environmental emissions, and lower levels of traffic congestion in metropolitan areas.

Table:7.1 Materials used in composites

<table>
<thead>
<tr>
<th>No.</th>
<th>Composite Material</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Glass fibre reinforced composite epoxy</td>
<td>M-1</td>
</tr>
<tr>
<td>2</td>
<td>Carbon fibre reinforced particle epoxy</td>
<td>M-2</td>
</tr>
<tr>
<td>3</td>
<td>Carbon fibre reinforced particle polypropylene</td>
<td>10% M-3</td>
</tr>
<tr>
<td>4</td>
<td>Glass fibre reinforced particle polypropylene</td>
<td>40% M-4</td>
</tr>
<tr>
<td>5</td>
<td>Glass fibre reinforced particles polyester</td>
<td>30% M-5</td>
</tr>
<tr>
<td>6</td>
<td>Glass fibre vinyl ester SMC</td>
<td>60 M-6</td>
</tr>
</tbody>
</table>

VIII. Conclusion:
The polymer composites in automobiles today are glass fiber-strengthened thermoset polymers utilized basically as a part of non-basic parts of the vehicle particularly for low- and mid-volume autos and trucks. Fiber-reinforced thermoplastics and, particularly, carbon fiber reinforced thermosets show incredible potential, the recent having double the weight decrease potential of glass fiber-strengthened thermoset polymers. Fiber-fortified thermoplastics impart the invaluable properties of polymer network composites and are likewise recyclable, have inconclusive time span of usability, and possible for robotized, high volume preparing with a potential for quick and low taken a toll creation. The expense is the absolute most real hindrance for the restricted utilization of polymer composites in cars today. Again renewable based bio-plastics are as of now being created and need to be researched more to overcome the execution constraints. Composites can supplement and eventually replace with petroleum based composite materials in a few applications consequently advertising new farming, natural, fabricating, manufacturing, advantages Durability, model criteria, and modular criteria were fulfilled too. Crash analysis, based on a static performance for frontal crash and rooftop crash was utilized to gauge additional mass requirement to notify the traveler cell structure.

Cost considerations were used to define potential materials and technological properties and process but cost modelling efforts are still underway and therefore cost competitiveness is still unknown.

Acknowledgments

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References


