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# Adoption Of Composite Materials In Truck Manufacturing Industry

Although the obliteration of the automotive manufacturing industry in Australia, truck manufacturing in Australia is thriving. With main industry shareholders such as Volvo and Kenworth making record amounts of trucks in Australia over the last year. The need for trucks continues to grow with more and more trucks finding their way onto Australian roads. Overtime the process and materials being used have changed with the industry wide changes occurring due to the use of robots for more of the production process and aluminium becoming a more popular option over the conventional steel.

However, this major change is occurring over a range of different industry and fields. The use of composite materials, materials which are now created using a mixture of two or more different materials to provide the optimum characteristics required in each different application. These materials have become favoured as they provide a host of benefits that have made them widely popular. The truck manufacturing industry should adopt this method of manufacturing for the truck cabs as the industry stands to gain many great benefits to the trucks being produced. Composite materials have become widely utilised because the mixture of two different material into one, can produce a product which has the strength of steel yet be as lightweight weight as Aluminium. A truck cab requires several criteria to meet to suit its intended purpose such as having a high amount of strength, durability to last a long period of time, being lightweight is ideal and the material must have a lot of plasticity to manipulate the truck body into an aerodynamical design. Since the start of truck manufacturing nobody has managed to incorporate these four criteria into a truck cab design until now.

As a shift to a glass fibre reinforced polymer will allow truck manufacturers such as Kenworth and Volvo the ability to design truck cabs which have the strength, durability, plasticity and are lightweight. Creating truck bodies in the past had been an environmentally unfriendly situation as the use of toxic paints and great amounts of pollution where required to make a truck body durable and prevent the truck from rusting and being attempting to make the steel used more sustainable. Steel provided the truck body with great strength however lacked the ability to remain durable as the natural elements lead to the bodies requiring coatings and paint to be used to delay rust occurring to the body of the truck. It also made for the truck bodies being unable to be made into aerodynamic shapes as the steel had no plasticity to remain strong. Aluminium has replaced steel in truck body manufacturing as it is light weight, corrosion resistant and provided more plasticity then steel ever did.

However, aluminium does not compare to the benefits that using a Glass Fibre Reinforced Polymer does. Moreover, the production and manufacturing of the truck cabs has a very different process to that used previously with spot welded metal panels. A truck cab produced with GFRP would require a process of design in which 3d modelling would be required to create a initial mould, followed by the entire truck production and manufacturing facility requiring a makeover to accommodate the changed production process, different resources and different equipment. Whilst much of the old equipment would become extinct a small portion of the old equipment could be recycled to be used in the process of making the GFRP cabs such as the robot arms. The setup for production of the truck cabs requires less expensive machinery and

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equipment than previous manners of manufacture did. A glass fibre reinforced polymer can be made with much simpler resources such as the resin, fibre reinforcement material, a brush and roller. It also would allow for less labour and less money being spent on resources to produce an ample amount of trucks bodies.

Furthermore, Software simulations and the finite element analysis will play an instrumental part in the design phase and in the production of the truck bodies. With a multitude of factors being considered into the final shape of the truck bodies. The design of the cabs is a very important stage of the manufacturing process as it is in this stage of the process that the true benefits of using such a different fibre reinforced polymer method are brought out. With the appropriate design the truck can be made more fuel efficient, aerodynamic and the plasticity of the material can be manipulated. Leading to the development of the mould and final design of the truck cab. Whilst changing the process of the way in which truck bodies are produced a lot of legal considerations and Australian standards need to be met and maintained. The production facility must meet the appropriate standards of occupational health and safety regulations to ensure the safety and health of the employees that will be producing the bodies.

Also, that the correct precautions are taken whilst working with dangerous and hazardous materials and chemicals as per specified in the material safety data sheet. The health of the labourers and staff at the production facility needs to be a number one priority as dust and noise will be generated at in high quantities. Also, money will need to go into the setup of a sustainable and environmentally friendly method to dispose of the volatile chemicals and waste produced. An essential consideration in changing over to the Glass Fibre Reinforced Composite manufacturing process is that when tested the final product can meet the standards set by the appropriate organisations. Therefore, requiring that a unit produced in glass fibre reinforced polymer be tested under numerous tests and situations to ensure that it adheres to the American society for testing and materials regulations.

Additionally, that the new material being used will have meet or have greater properties than the previous materials used before it and there is no compromise in the safety of quality of the final product. Composite materials are very complex and producing a composite material with the desired characteristics takes a lot of calculation and understanding of the way in which the matrixes of combining two different materials will react. The report will extensive highlight the benefits, considerations and disadvantages of the truck industry changing the material and method of producing truck bodies or cabs. It is stipulated that there are two main types of composite materials which are created they vary differently in the way the matrix of the two materials occurs.

Fibre Reinforced Composites (Ceramic Matrix) as named contained three different materials in the formation of the final resultant material generated. The two materials being mixed and fibres which help to reinforce the strength of the overall final material most common for durability and Particulate Reinforced composites (Metal Matrix) Similar to fibre reinforced composites however they do not contain the fibres to reinforce the overall strength of the composite. Instead given a composite in which the two materials are the only ones merged, and typically produces a material not as strong as fibre reinforced composites. For creating truck bodies, the composite material being utilised will be a fibre reinforced composite as it produces greater strength and durability.

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Decking - Concrete Driveways- Airplanes - Boats- Ships- Cars - Electronics - Infrastructure  
Process of Manufacturing a Glass Fibre reinforced composite  
The truck bodies can be made through three different common industrial methods of - Open Moulding - Closed Moulding- Cast Polymer Moulding  
Open Moulding The Glass Fibre Reinforced Composite is made using an open mould which the fibres are impregnated into the mould with the resin.

## Closed Moulding

Where a closed two-sided mould is filled with resin and fibre reinforcement. Followed by vacuum bagging to remove air bubbles and pockets whilst the product cures inside the mould.  
Cast Polymer moulding Is a technique of moulding where the mould has a large bezel edge with normally a shaped pultrusion to give extra strength to the final product, mainly only used in applications which great strength is required in the product?

## Manufacturing with Glass Fibre Reinforced Polymer

The first step of manufacturing a truck cab from scratch is to create a mould of the shape and design of the anticipated final product created by the design crew. The mould can be created from a range of different materials however fiberglass is the most preferred choice, as it enables the full ability to obtain contoured and aerodynamically shaped bodies. Which are harder and nearly impossible to mould with other materials such as wood which lack plasticity. With the finalised mould complete it must be lined with a release agent so that once the truck cab is created it can be separated easily without damage occurring to the freshly produced piece that has been created. The release agent makes the final product glass fibre reinforced polymer body slide out of the mould without cracking or fracturing. The exterior coating of the truck cab is first hand laid up into the mould.

Normally a gel coating, the coating enables the exterior of the cab to have a smooth and coloured finish. Following this gel coating being applied to the mould, the resin and fibre reinforcing are impregnated subsequently by being hand rolled onto to remove air pockets which can form with in the matrix of the truck body being produced. By hand rolling the air pockets to remove any irregularities which could form once the final product hardens. A timelier method that can be utilised that is more cost efficient for a higher volume production is a method called spray up in which a chopper/spray gun is used to spray a large open mould. This method is ideal for an operation in which there is a high demand for objects which have a larger mould or surface area, and using the hand lay up method would take more time and slow down production. Both would require rolling out of the final product.