Effect of Nano Fillers On Advanced Vacuum Bagged Kenaf Fiber Reinforced Composites for Automotive Applications

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Introduction

Kenaf is an herbaceous annual plant that is grown commercially in the USA in a variety of weather conditions, and it has been previously used for rope and canvas. Kenaf has been deemed extremely environmentally friendly for two main reasons: (a) kenaf accumulates carbon dioxide at a significantly high rate and (b) kenaf absorbs nitrogen and phosphorous from the soil.

Vacuum assisted resin transfer moulding (VARTM) process is a variant of vacuum-infusion RTM in which one of the solid tool faces is replaced by a flexible polymeric film. This process or a modified version is also known as vacuum infusion or SCRIMP. The VARTM process is a very clean and economical manufacturing method: the process draws resin into a dry reinforcement on a vacuum bagged tool, using only the partial vacuum to drive the resin.

Calcium carbonate is a chemical compound with the chemical formula CaCO3. It is a common substance found in rocks as the minerals calcite and aragonite, most notably in chalk and limestone, eggshells, gastropod shells, shellfish skeletons and pearls.

Aluminium oxide is a chemical compound of aluminium and oxygen with the chemical formula Al2O3. It is the most commonly occurring of several aluminium oxides, and specifically identified as aluminium oxide. It is commonly called alumina and may also be called aloxide, aloxite, or alundum in various forms and applications. It occurs naturally in its crystalline

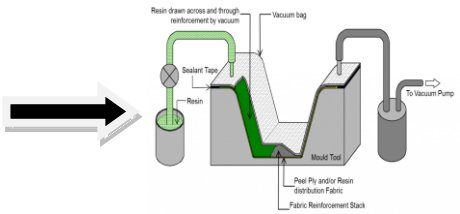
polymorphic phase α-Al2O3 as the mineral corundum, varieties of which form the precious gemstones ruby and sapphire.

Objectives:

- To replace glass-fiber sheet moulding compound (GF-SMC) using natural fiber-reinforced composites (NFRCs) in the automotive industry.
- The regular NFRC can have the 24-h water absorption and thickness swelling of Aluminium oxide impregnated NFRC will be significantly reduced.
- The contribution of nano fillers (75-100 nm) will enhance the mechanical properties.
- The use of advanced VARTM process we can achieve a superior form of composite.
- The results will be demonstrated that the environmental burdens of the composites will be reduced when Kenaf fibers were used.

Methodology:

It utilizes a flexible film to enclose the part and seal it from the outside air. The vacuum bag material is accessible in a tube shape or a sheet of material. Then, a vacuum is drawn on the vacuum bag, and atmospheric pressure compresses the part during the cure. When a tube-shaped bag is used, the entire part can be enclosed within the bag. When utilizing sheet bagging materials, the edges of the vacuum bag are sealed against the edges of the mould surface to enclose the part against an air-tight mould.



KENAF FIBER **ALUMINIUM OXIDE** **VACCUM BAGED PROCESS**

MODIFIED FIBER

MECHANICAL PROPERTIES

PHYSICAL PROPERTIES

APPLICATIONS

When bagged in this way, the lower mold is a rigid structure and the upper surface of the part is formed by the flexible membrane vacuum bag. The flexible membrane can be a reusable silicone material or an extruded polymer film. A vacuum is drawn on the part (and held) during cure after sealing the part inside the vacuum bag. This process can be fulfilled at either ambient or elevated temperature with ambient atmospheric pressure acting upon the vacuum bag. A vacuum pump is used usually to draw a vacuum. A cost-effective method of drawing a vacuum is with a venture vacuum and air compressor.

Results and Conclusions:

This project aims to study the mechanical properties of hybrid polymer composites and the addition of primary and secondary fillers the Nano aluminium oxide and Nano calcium carbonate to the Kenaf epoxy composites. The vacuum bagging method is to be used to fabricate the composites. The advantage of using vacuum bagging is to reduce blowholes. The weight ratio of Kenaf fibre 50-60%, matrix 40%, fillers Nano aluminium oxide 10-15%, and nano calcium carbonate 10-12.5% is considering. Mechanical properties like Tensile strength, Young's modulus and elongation, flexural strength, and compression strength is to be tested.

Conclusions:

The effect of Nano fillers on advanced vacuum-bagged kenaf fiber reinforced composites for automotive applications is significant and offers several advantages. The addition of Nano fillers to the composite matrix enhances the mechanical properties, thermal stability, and overall performance of the kenaf fiber reinforced composites.

Improved Mechanical Properties: The incorporation of Nano fillers, such as Nano Calcium Carbonate and Nano Aluminium Oxide in the kenaf fiber composite leads to improved mechanical properties. The Nano fillers enhance the interfacial bonding between the kenaf fibers and the matrix, resulting in increased tensile strength, flexural strength, and impact resistance. The presence of Nano fillers also improves the stiffness and hardness of the composites, making them suitable for automotive applications that require high structural integrity.

Scope for future study:

Based on the work carried out for the same composites, scope for the future works as follows –

1. Machinability process such as Drilling properties
2. Wear Properties