DESIGN OF PLASTIC RIM FOR INDUSTRIAL AND COMMERCIAL LIGHT VEHICLES USING MODELING AND SIMULATION TOOLS

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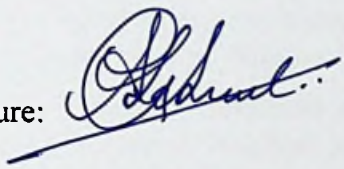
Signature:  Date: 14th June 2017

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Abstract

The present research was devoted to designing a plastic rim for industrial and commercial light vehicles using modeling and simulation tools.

The main objective of the design project was to design a rim structure that would be capable of sustaining the required load and performing under provided service conditions. In order to select a suitable thermoplastic composite a series of plastics was experimented. The selection of material was based on several factors, including mechanical strength under dynamic load, resistance to prolonged action of elevated temperatures and ability to be molded with conventional techniques. The materials which were considered for the design included Polyamide 6, Polyamide 6 with 50% long glass fibers, Polyamide 6 with 50% short glass fibers and Polyamide 6 with 30% short glass fibers, out of which Polyamide 6 with 30% short glass fibers was selected due to it being less brittle, that aided the material to withstand service and accidental impact. Another criterion that supported selected material was associated with its ability to be injection molded with conventional type injection molding techniques.

Four models were developed based on general plastic product design standards. Each model was simulated in order to identify areas of potential failure. After that model was optimized by changing its structural arrangements so as the stresses in the potential failure areas were reduced. Next step in modification and optimization of the model was done for product mold-ability.

The model which comprised a solid body of rim portion with a center bore configured to receive axle hub, an inner band, a circumferentially extended outer band that margined the rim portion, a nave ring that extended outwardly and radially of said center bore wherein a plurality of holes were circularly positioned that were configured to receive bolts, a plurality of ribs extending outwardly and radially at right angles from the nave ring up to the outer band were positioned both sides of the rim configured to improve flexural rigidity of the structure was accepted for fabrication by means of reinforcement of hub hole area with metal plate.

A manufacturing method of plastic rim was selected based on the material processbility, manufacturing cost and efficiency for serial manufacturing and commercialization. Prototype Injection mold was manufactured using cheap and easy to machined steel P-20. Produced standard mold was modified to improve ventilation and to facilitate flow of the plastic melt through the flow path of the injection mold from machine nozzle to cavity

The successful prototypes and destructive tests carried out affirmed suitability of the Solidwork Design package and Solidwork Simulation Package for designing, manufacturing and prediction of load bearing capability of the plastic rim. The application of Solidwork Simulation Package during designing stage lead to reduced implementation cost and reduced reproduction numbers of prototypes to evaluate product suitability, thereby making implementation of the final product efficient.

The main advantages of using plastic composite material for automotive rims included energy efficiency and easy maintenance due to lower weight

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