

Redesign of Integrated Headlamp and Fender with Green Plastic for Weight and Cost Reduction



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Abstract:

The impact of today's vehicles on the global environment has forced the automakers to invest large amounts into research and development. An important element for this is to develop light weight, low-cost and eco-friendly material. Plastic has played major role in replacing the sheet metal parts. Materials like polypropylene, polyurethane and PVC are the most popular in automotive industry. To improve the properties of plastic material fillers are added into it, but these fillers are also a big concern as per environment regulations, because of which automakers are moving towards wood polymer composites. The present study is focused on integrating headlamp with fender using green plastics for reducing weight and cost.

The design process for integrated headlamp and fender was started with detailed literature survey and GEMBA study in which suggestions were collected from different sources. Based on that, Quality Function Deployment (QFD) was generated and importance of the product was highlighted. Five concepts were generated based on QFD and Product Design Specification (PDS) was drawn. Best concept was selected based on the Pugh matrix method. CAD model for the selected concept was generated using CATIA. Ribs and stiffeners were designed to improve the strength of the part. Simulation for the better mouldability of the component was done using Autodesk Mold Flow. Tool iterations were done on shape and size of runner and gate, gate location and number of gates for better mouldability of the component.

From the study it has been observed that, there was a reduction in overall weight of the component by 70-75%, cost by 60% and the time required to assemble the component in the vehicle by 40%. Eco audit for the component was done using Cambridge Engineering Selector and it was found that, the emission of CO₂ can be reduced from 18.5 kg to 14.3 kg per component. Finally 1:2 scaled mock-up model was made using teak wood and plastic sheet for the validation of the design.



Final concept selection



Digital model of final concept



Mould flow analysis

| Column | Metal fender | Plastic fender |
|-----------------------------|----------------------------|---------------------|
| Size | 1226 X 697 X 200 | 1226 X 697 X 200 |
| Weight | 6.8 kgs | 1.3 kgs |
| Price | 2500Rs/piece (TATA Indica) | 1500Rs/piece (Est.) |
| CO2 Foot print (asper CES) | 18.8 kg | 14.3 kg |

Advantages of plastic fender over metal fender