Heat Dissipation Inside Lamp and Vent Position to Avoid Condensation Issues

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Abstract: Headlamp of the automotive imparts changes in heat along with exchange of low air which may cause fogginess to enter into it, and generates condensation inside the headlamp. The growth of the organizations is improving nowadays and highly competitive, they mainly anticipate reducing the expenses. The hot air will be generated from the headlight lamps during driving as similar to the warm air emitting from the fan which is the phenomenon of defogging effect. These air need to be ventilated to reduce the effect of condensation. It is important for the automotive manufactures to consider the effect of condensation to enhance the performance. This work describes the solution to the issue by providing vents in the lamps to draw the moist when the vehicle is turned off. When the outer lens cools rapidly than inner, the condensation occurs. It is necessary to remove the moist since the water inside the lamp can spatter and reduce the effect of lights by preventing the light to shine. The mold will be formed inside the lamp due to the presence of water which also in turn reduces the effect of light.

Keywords: headlamp, hot air, defogging effect, moist, mold, effect of light.

1. INTRODUCTION

A headlamp is a lamp attached to the front of a vehicle to light the road ahead. Headlamps have to cope with environmental conditions that change every day. They have to be protected against dust, dirt, deposits, and condensation if they are to work effectively and guarantee drivers a clear view at all times. Various options are available to automobile manufacturers and suppliers for removing moisture from headlamps. When selecting a venting membrane as an option, the solution must be able to equalize pressure within the headlamp housing, form an effective barrier against dirt and water ingress, and be able to reduce condensation. Moisture in headlamps comes from three main sources (Figure 1.1). The most common of the three is desorption, which is triggered by differences in temperature. When the light source is switched off, the temperature drops and the plastic that the headlamps are made of soaks up moisture like a sponge. When the light source is switched on again, the temperature rises, releasing this accumulated moisture from the material (Figure 1.2). At the same time, the dew point rises, this can cause condensation to form at the coldest place in the headlamp. The next time the light source is switched off, the temperature drops and the plastic absorbs moisture. This process accounts for roughly 80% of the moisture in headlamps. Permeation is the second source of moisture: a process by which water vapor from the outside continuously diffuses through the plastic into the housing interior over a longer period. The third cause of moisture is the vent itself, through which moisture can get in and out of the headlamp.

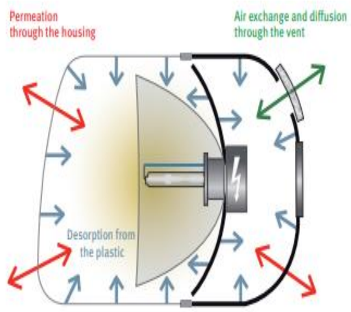

Fig 1.1 Causes of moisture in vehicle headlamp

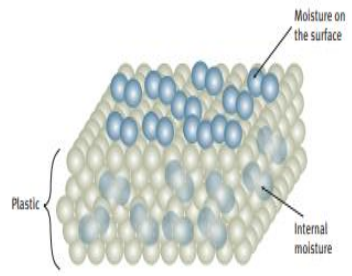

Fig 1.2 Over 50 % of all the moisture that desorbs is surface moisture

2.EXPERIMENTAL PROCEDURE

2.1 MODELLING OF COMPONENT BY USING CATIA (HEAD LAMP HOUSING):

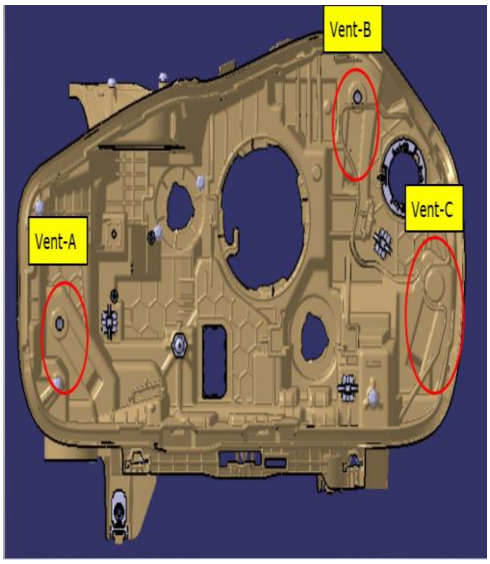

Fig 2.1Modelling in CATIA V5

On the housing file using **Catia** tools and commands we created fixation features. These fixations are used to mount whole headlamp with car body. As per the sketch recommends the fixation features has to be created. Using sketch, part, surface workbenches we need to create this definitions. While designing this features it is obvious to refer the specifications given by the car makers and also the consideration of 2.1.1 principle is also must. The housing should be designed in such a way that it should arrest 3 degrees of freedom.

2.1.1 Steps involved in CATIA

- D MODELLING USING CATIA
- THERMAL SIMULATION USING ANSYS
- THERMAL REPORT
- VENT POSTION CONFIRM

2.2 ANALYSIS USING ANSYS(THERMAL)

Table 2.1 Material specifications detail

Material character and DGL request	
Co efficient of thermal expansion	User Material PPT40(Black) at 23°C
Young's modulus	3800 Mpa
Poisson's ratio	0.35
Density	1230 Kgm^3
Co efficient of thermal expansion	0° K deg
yield strength	27 Mpa

2.2.1. DYNAMIC CLEARING CONDITION

Ambiance:

$T_{housing} = 5°C$

$T_{air} = 10°C$

$T_{lens} = 5°C$

Assumptions:

- 5 microns constant condensation film applied to the lens
- Ventilations are in a cold engine area
- Ventilation in a hot area will be against our objective

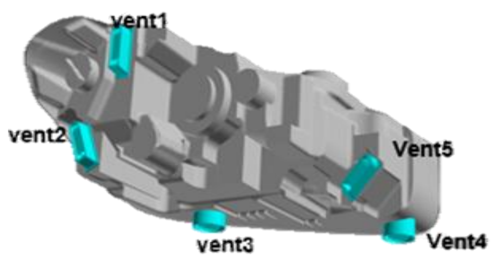

Fig 2.2 Dynamic clearing condition simulation

Table 2.2 Configuration 1

Function	Switch ON/OFF	Cycle Physics
LB(H7)	ON	Continuously
HB(H7)	OFF	---
DRL (LED)	ON(PL)	Continuously
TI (PY21W)	OFF	---

Table 2.3 Configuration 2

Design	Configuration 2	Configuration 3 (Conf1+windows)
Vent-1 (White-tube)	Open	Open
Vent-2 (White-tube)	Open	Open
Vent-3 (Rosetta)	Closed	Closed
Vent-4 (Rosetta)	Closed	Open & Inlet 10Pa
Vent-5 (White-tube)	Open & Inlet 10Pa	Closed

2.3 CONDENSATION TEST & REQUIREMENTS

2.3.1 Requirements

- Complete de dewing after 35km drive.
- Condensation removal must take place at least as quickly as that of the reference vehicle.

2.3.2 Test documentation

- Documentation of the condensation as shown in the example (blue line shows condensation) in Fehler verweisquelle konnte nicht gefunden warden.
- This is a car diving test for clearing the condensation to confirm: which is the "reference of vehicle".
- Pressure mapping on the ventilation with car speed 100km/h.
- Thermal mapping on the engine environment

2.4 CONDENSATION ZONE ANALYSIS:

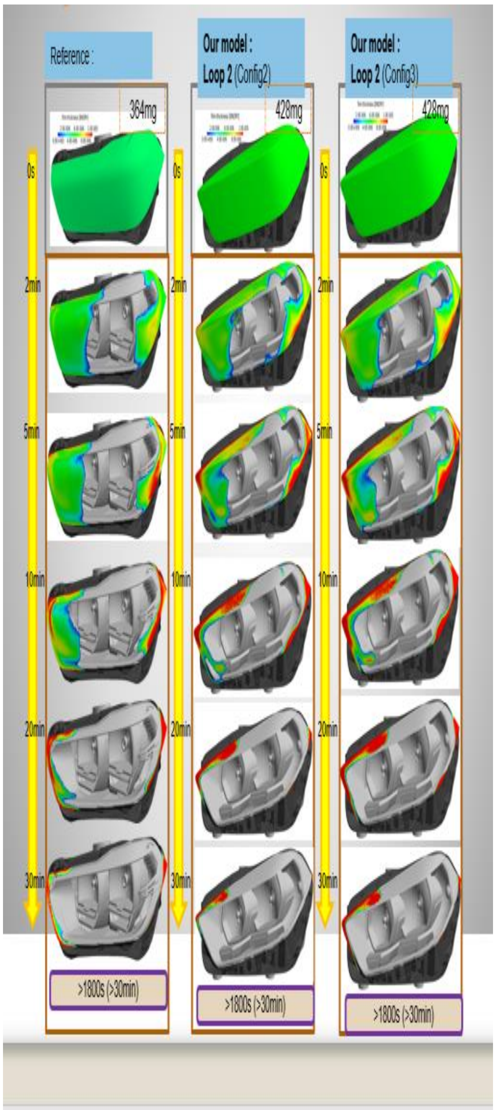

Fig 2.3 Analysis of condensation zone

2.5 CONDENSATION FILM THICKNESS

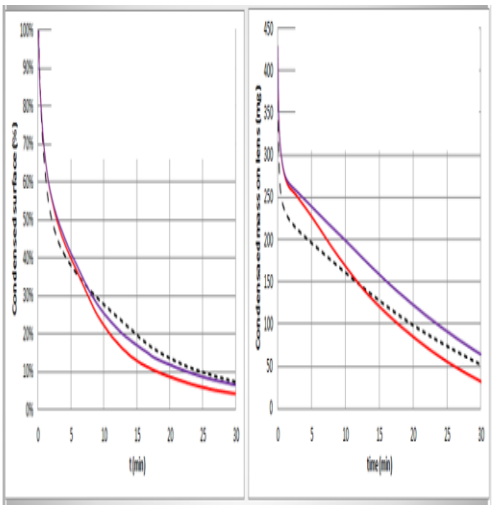

Fig 2.4 Analysis of condensation curves

- The clearing behavior of our project Halogen is slightly better than the clearing behavior of reference, which had good results in the car tests.

2.6 TEST RESULT

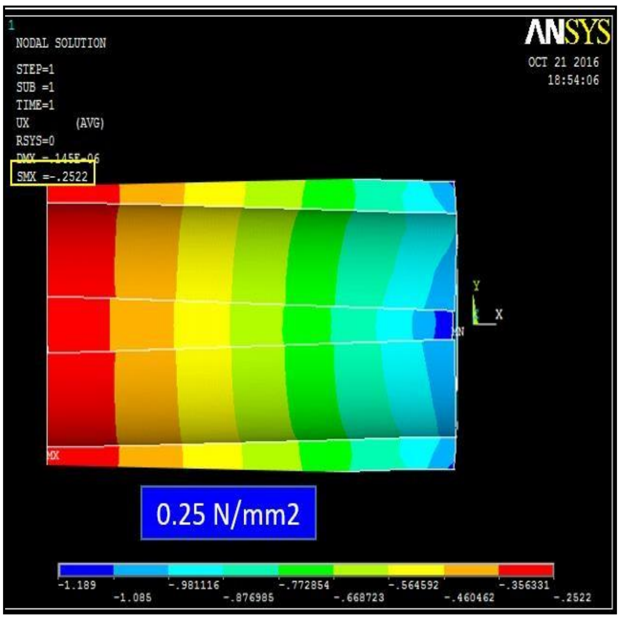

Fig 2.5 ANSYS Model stress result

- After the vent holes provided inside the headlamp housing.The stress acting in the headlamp housing is 0.25N/mm2.

3.CONCLUSION

Condensation in headlamps is the factors reducing the shine of light. To provide a solution, we designed headlamps with vents in CATIA V5 and thermal analyses carried out in ANSYS. From the literature study the type of vent need to reduce the fogging effect is chosen accordingly. Polypropylene plastic material possesses better performance for vents as per literature analysis. From above results it's clear that CATIA V5 giving more stress values than ansys, with integrated analysis experience which helps us to design our Ribs stronger for car headlamp housing. Ribs can be designed robust by these optimistic results from CATIA V5 to avoid mechanical failures in real time. High consideration gives high factor of safety for designing a component. We have designed headlamp housing fixation definitions ANSYS, correlated and results compared, thus we are giving declaration. In automotive lighting field that CATIA V5 is enough to get design robustness in housing. We analysed and positioned its best place inside the headlamp. Nowadays condensation plays vital role in headlamp, we don't have proven method for analysis it structure. All OEM follows their own method according to their successive rate.

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