ANALYSIS OF HONEYCOMB SANDWICH PANEL FOR APPLICATION OF DOOR MATERIAL FOR LIGHT WEIGHT VEHICLE

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Abstract— Car door is one of the main parts which are used as protection for passengers from side collisions. Presently steel is used for car doors construction. The aim of the project is to analyze the car door with presently used material steel and replacing with composite materials like Honey Comb Structure. Weight reduction is now the main issue in automobile industries. Traditionally most common material for manufacturing vehicle Door is mild steel, in various forms. Over time, other materials have come into use, the majority of which have been is steel and Aluminum. In this project traditional materials are replaced with compositematerials. Using reverse engineering method.(Existing model, modified model, honey comb model).Impact analysis is conducted on door for different speeds by varying the materials. Best of the result we will consider for the door design. Also we are going to reduce weight of the door by using composite materials. By this we have to reduce the damage percentage of the car and passenger protection. In this project, the Car door is modeled using parametric modeling software Pro/Engineer. Pro/ENGINEER is the standard in 3D product design, featuring industry-leading productivity tools that promote best practices in design. We have to variety the materials of the car door and speed to impacting of door

Keywords—Honey comb, Door Panel

I. INTRODUCTION

The vehicle doors are generally hinged, whereas sometimes attached by other mechanisms such as tracks, in front of an opening which is used for entering and exiting a vehicle. A vehicle door can be opened to provide access to the opening, or closed to secure it. These doors can be opened manually, or powered electronically. Powered doors are generally used in minivans, high-end cars, or modified cars. Unlike other types of doors, the exterior side of the vehicle door contrasts sharply from its interior side (the interior side is also known as the car door panel): The exterior side of the door is made of steel like the rest of the vehicle's exterior. The central purpose being to add to the overall aesthetic appeal of the vehicle exterior.

On the other hand, the vehicle door's interior side is typically made up of a variety of materials, sometimes vinyl and leather, cloth and fabric. Because the car door panel is typically intended to match the rest of the styles used in the car's interior, the choice of cover materials depends on the rest of the styles used in the vehicle's inner body like the dashboard, carpet, seats, etc. However, unlike the material used on the exterior side of the vehicle door, the material on the interior side serves a greater purpose other than just aesthetic appeal. While the materials that makes up the interior side are intended to match their surroundings and contribute to the overall aesthetic appeal, there's an additional purpose of coziness and comfort.

A. Composite Material

The environmental and economic reasons as well as the need for improved designs in the manufacture of motor vehicles have imposed mass reduction as the fundamental criterion for their construction. These requirements include first of all the use of light materials which necessarily combines the knowledge of several engineering disciplines. Thus today, design, the Improved Vehicle Dynamics Payload Safety, Less Kinetic Energy Durability Availability for Features Increase Reduced Mass Cost Fuel Economy Performance Emissions Braking Figure 1 - Influence of weight reduction on properties and features . Auxiliaries Aerodynamic resistance Rolling resistance Inertial resistance Transmission losses Combustion losses 3% 4% 4% (Related to weight) 5% (Related to weight) 1% 83% Figure 2 - Driving force for weight reduction – complete energy flow in EU combined (5-cyl-gasoline engine) science about materials and production interactively supplement each other trying to reduce the structural mass by considering not only the mass of all its single components but rather also the possibilities of improving their functionalities.According to the theoretical considerations, vehicle mass reduction of 10% reduces the fuel consumption by about 5.5%.

The highest share in the total mass of vehicle are traditional heavy metals such as iron, steel and copper .Light metals, polymers and their composite products in industrial practice are no unknowns and have already started to be used as substi- K. Miloš, I. Jurić, P. Škorput: Aluminium-Based Composite Materials in Construction of Transport Means 88 Promet – Traffic&Transportation, Vol. 23, 2011, No. 2, 87-96 tute solutions. However, their share in the total mass reduction is significantly reduced by improving the vehicle design, transmission efficiency, safety-critical structures and comfort (anti-block systems, airbags, air-conditioning systems, etc.). Today's requirements for more radical interventions impose their more intensive development and implementation. The developed production techniques, modelling simplicity and consequently low prices, make the heavy monoliths, especially steel and its versions still the most competitive materials .Light metals such as aluminium, magnesium and titan both because of the production price and because of the limitations by basic properties make it difficult to expand the usage spectrum.

These high requirements have brought the composite materials into the focus of present research. The potential of composite materials, as macroscopic combinations of dissimilar materials has been recognised in unlimited possibilities of moderation and combination of the desired properties of the constituents . Depending on the purpose of composites, one or several materials (hard phase), of different morphologies are integrated into the matrix material, forming thus very diverse spectrum of properties of hybrid products – composites, which regarding purpose exceed greatly the usage limits defined for the traffic means.

B. Honey Comb Structure

Sandwich panels are used for design and construction of lightweight transportation systems such as satellites, aircraft, missiles, high speed trains. Structural weight saving is the major consideration and the sandwich construction is frequently used instead of increasing material thickness. This type of construction consists of thin two facing layers separated by a core material. Potential materials for sandwich facings are aluminum alloys, high tensile steels, titanium and composites depending on the specific mission requirement. Several types of core shapes and core material have been applied to the construction of sandwich structures. Among them, the honeycomb core that consists of very thin foils in the form of hexagonal cells perpendicular to the facings is the most popular.

II. FEA OF STEEL DOOR

The analysis was done using Load of 5kN and 10 kN

A. Material

The material selected as MS for Honeycomb Sandwich Panel is EN47. The material properties for design are listed in Table.2.1. Plain carbon steel, chromium vanadium steel, chromium- Nickel- Molybdenum steel, Silicon manganese steel, are the typical materials that are used in the design of Honeycomb Sandwich Panel.

Table 1: Properties of Honeycomb Sandwich Panel.

Parameters	Values
Material selected as MS	En47
Tensile strength	210GPA
Yield strength	1158MPA
Young's modulus(E)	1034MPA
Poisson ratio	0266
Density	7700

B. Model of Door

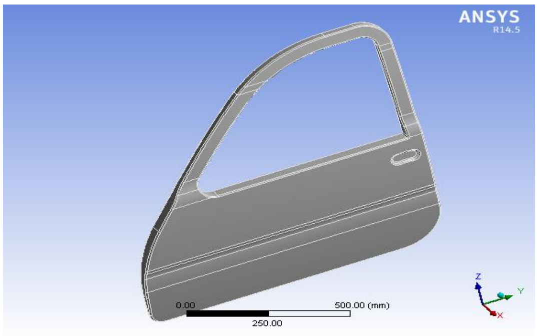

Fig. 1. Model of Door

A. The analysis was done considering a load of 5kN

A. Equivalent Stresses

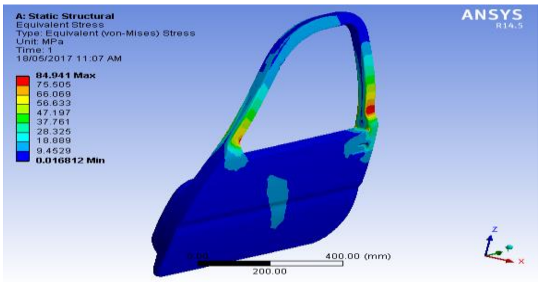

Fig. 2Equivalent stresses in Steel door

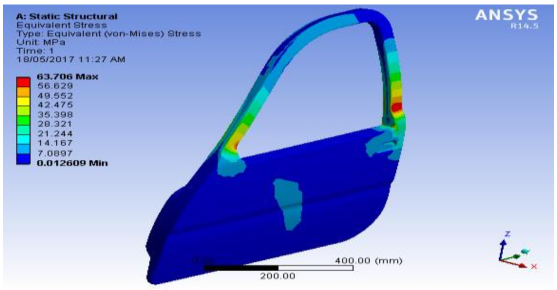

Fig. 3 Equivalent Stresses in Honey Comb Door

B. Total Deformation

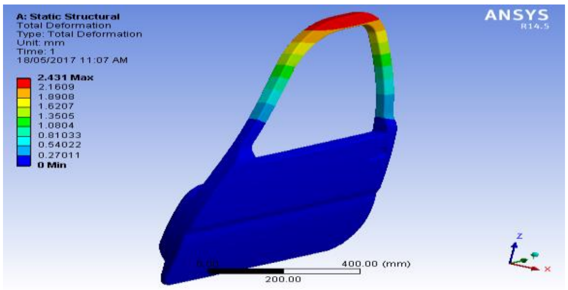

Fig. 4 Total Deformation in Steel door

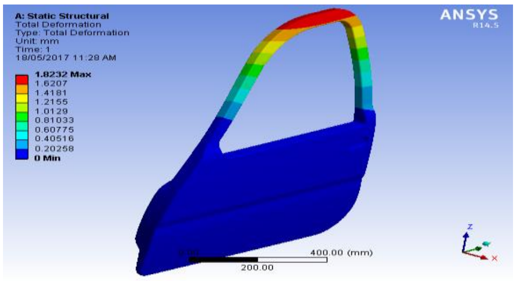

Fig. 5 Total Deformation in Honey Comb Door

C. Equivalent Strain

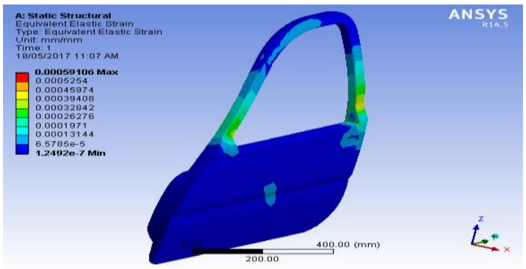

Fig.6 Equivalent Strain in Steel Door

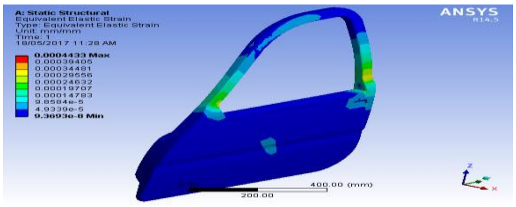

Fig. 7 Equivalent Strain in Honey Comb Door

B. The Analysis was done using the load of 10 kN

A. Equivalent Stresses

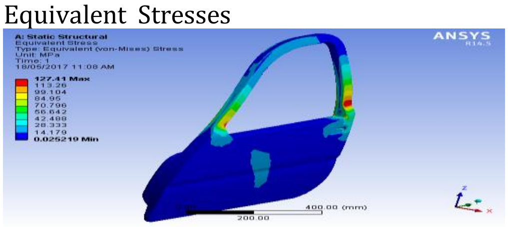

Fig. 2Equivalent stresses in Steel door

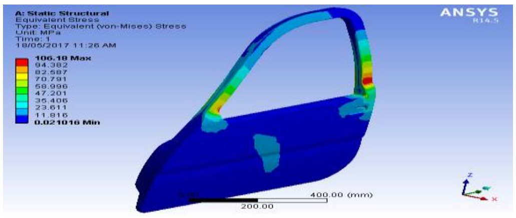

Fig. 3 Equivalent Stresses in Honey Comb Door

B. Total Deformation

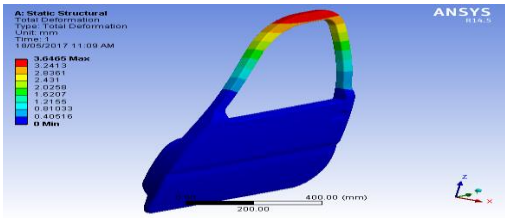

Fig. 4 Total Deformation in Steel door

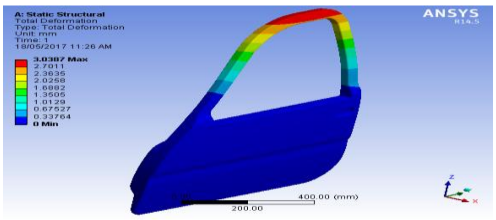

Fig. 5 Total Deformation in Honey Comb Door

C. Equivalent Strain

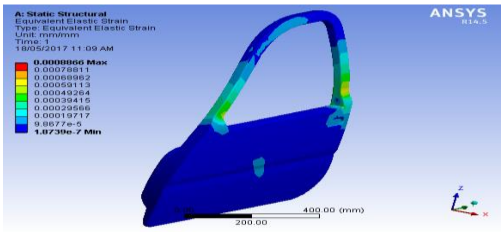

Fig.6 Equivalent Strain in Steel Door

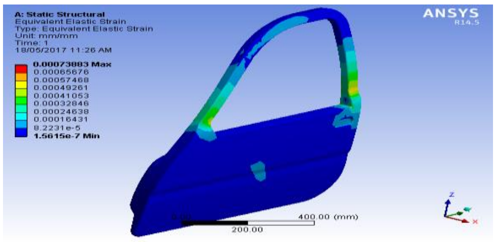

Fig. 7 Equivalent Strain in Honey Comb Door

III. RESULT

Table 2: FEA Steel Result

Pressure	Deflection	Stress	Strain
5KN	2.431	84.941	0.00059106
10KN	3.6465	127.41	0.0008866

Table 3: FEA Honey Comb Result

Pressure	Deflection	Stress	Strain
5KN	1.8232	63.706	0.0004433
10KN	**3.0387**	**106.18**	**0.00073883**

IV. CONCLUSION

Finite Element analysis of the impact of the car door is done using FEA tool. From the results obtained by using FEA analysis, following discussions have been made. In this study, Steel and honeycomb materials are used for side-door impact, for passenger cars. The door was designed to reduce weight, as well as to improve impact energy absorption. Structural modifications were done using FEA, in order to determine a suitable cross-section for the side-door impact. Furthermore, the impact energy absorption characteristics of steel, honeycomb were also investigated using impact test.

1. Results show the improvement in the strength of the door as the maximum limits of stresses.

The value of von-misses stresses that comes out from the FEA is far less than material yield stress so our design is safe.

2. The strength of the car door is also increased (weight Reduction) from change of material from steel to epoxy.

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