COMEC

The 10th International Conference on COMPUTATIONAL MECHANICS AND VIRTUAL ENGINEERING

Transilvania University of Brasov
FACULTY OF MECHANICAL ENGINEERING

25-27 October 2023

The mechanical behavior of fiberglass-based materials used for a car element

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Abstract: *Many components of today's vehicles are made of composite materials. The composite materials from which these markers are made are chosen depending on the role these components have in the vehicle as a whole. When choosing the material used to make car parts, the technology for obtaining these components plays an important role. However, composite materials are increasingly making their way into the automotive industry. Their use for the production of automotive benchmarks must be done with knowledge in order to achieve maximum performance without raising production prices.*

Keywords: *fiber glass, composites, automotive*

1. INTRODUCTION

In the current stage of development of the world economy based on the laws of the market economy, the correct choice and use of materials and their processing processes must be done according to scientific rigor, in order to respond to ever greater demands. During the design process, the optimal choice of materials is made according to the conditions of use, the existing demands, the processing processes, the shape, dimensions and performances of the products, the current regulations and last but not least the cost.

Regarding the cost, in the automotive industry there is a trend in finding products that are cheap, durable and easy to use for complex and simple geometries as well.

The replacement of the metallic materials used until now, in the automobile manufacturing industry, has led to an increase in the duration of operation, an increase in the absorption of noise and vibrations for the external and intercompartmental insulation of motor vehicles, as well as for absorbing the kinetic energy of shocks in the event of accidents. In the field of car rooftops,

it is expected to use composite materials that ensure greater flexibility and resistance under the current changing weather conditions, as well as during impact.

If an analysis is made of the lifespan of automobile models, it is observed that the period of time until the appearance of a new model is getting shorter and shorter. Thus, car manufacturing companies release improved models on the market at very short intervals. This reduction in the life period is due to the advanced technology, the imposed comfort and safety requirements and the competition in this market, of automobiles. The intense competition has allowed the automotive industry to have a particularly dynamic aspect. This dynamism is a strong incentive for the industry. In order to ensure a large number of components, a large volume of raw materials and manufacturing technologies is needed.

The aim of the paper is to propose a comparison between possible materials for the car rooftop, such as fiber glass reinforced panels, which have a good behavior, both mechanical and thermal.

2. MATERIALS

Due to the fact that composite materials have a low strength-to-weight ratio, a good resistance to wear and corrosion, they have begun to replace more and more traditional materials.

The inherent damages, which appeared during the creation of the composite, are related to the defects of the constituent materials, but also to the manufacturing technology. These damages are produced by non-uniformities of the thickness of the layers, the lack of parallelism between the fibers, interruptions of the fibers, voids (air pockets) or other imperfections in the structure, delaminations, but also due to inadequate or incorrectly used tools.

A vehicle includes many types of materials: metal, plastic, textile, etc. The percentages vary depending on the type of vehicle, its destination, the climatic zone in which it will be operated, the performances it develops, or the social class to which it is addressed. But prime materials are a limited resource. Therefore, the need for new materials, which have the potential to be recycled with low impact on the environment.

The considered material in this case is fiberglass.

Figure 1: 6 mm thick samples before and after tests

3. TESTING

In the table below are presented the maximum values recorded for the load and the extension in each sample. The specimens were tested at room temperature(21°C):

Table1. Specimens 3 mm

No. Specimen	Load [N]	Extension [mm]
1	433.73	9.12
2	342.72	9.16
3	431.12	8.97
4	440.66	10.45
6	459.15	9.71

Table2. Specimens 6 mm

No. Specimen	Load [N]	Extension [mm]
1	799.86	6.30
2	873.45	6.42
3	798.67	6.13
4	627.93	4.92
5	514.89	4.59
6	596.34	4.82

Figure 1 shows the cumulative Load-Extension graph recorded during the bending stress of all six specimens. The breaking point of the specimen is considered the first point where a drop in the stress force recorded graphically occurs.

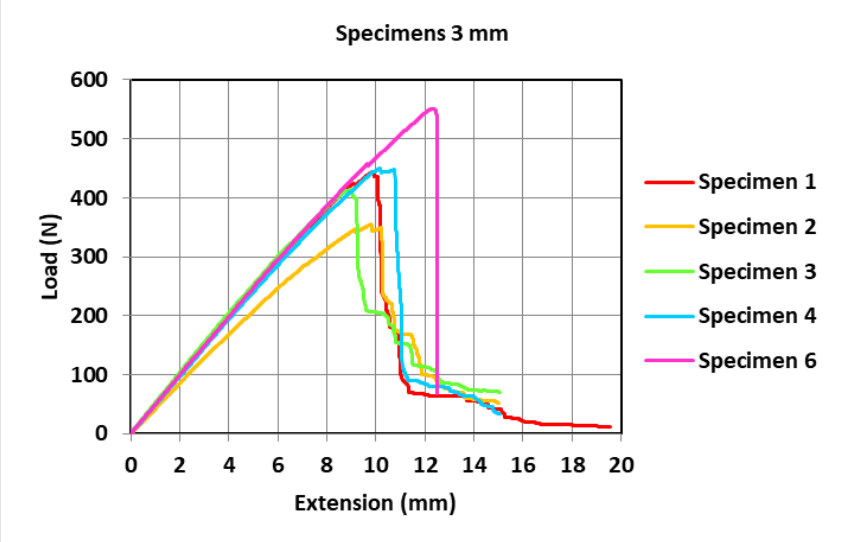

Figure 2: Load Extension diagram for 3 mm thick samples

Figure 2 shows the Load-Extension graph obtained during the bending stress of samples 1,2,3,4 and 6. For sample 5 an error was encountered during measurement. The Specimens in this testing batch were 6 mm thick. The breaking point is considered as in the first case, the first drop in stress.

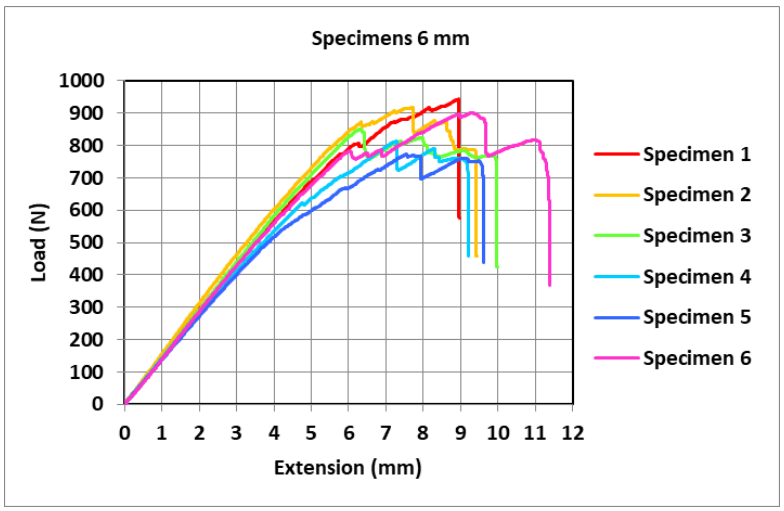

Figure 3: Load Extension diagram for 6 mm thick samples

The specimens were made of polyester resin reinforced with several layers of RT 800 glass fiber fabric failed in the mid-zone during the tests.

Figure 4: 6 mm thick samples and after tests. Breakage in the middle section.

4. CONCLUSIONS

The composite material made of polyester resin, reinforced with glass fibers withstands a considerable load under normal temperature conditions. The used material has high potential to be used instead of conventional materials, withstanding loads without problem. The presented results were given at the first breaking point, the samples keeping their integrity even thou there were recorded ruptures in the structure. This is an advantage compared to conventional materials.

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