Table 6 shows the different conditions used, two different forces and impact speeds. In all cases the crash duration time is 0.1s and a car mass of 1262 kg was considered.

	Impact force (kN)	Impact velocity (m/s)
Sim-1	70.11	5.56
Sim-2	105.17	8.33

Table 6 Simulated crash conditions

Figure 8 shows the results obtained for the Model under Sim-1 conditions; similar results were obtained in all simulations. The maximum stress and deformation were observed on the collision point. Varying the impact force and / or the impact velocity, the magnitude of the stress and deformation is modified. However, in all cases due to the mechanical properties of the material the bumper fascia absorbs the impact, preventing it spreading stresses and destroying the entire piece.

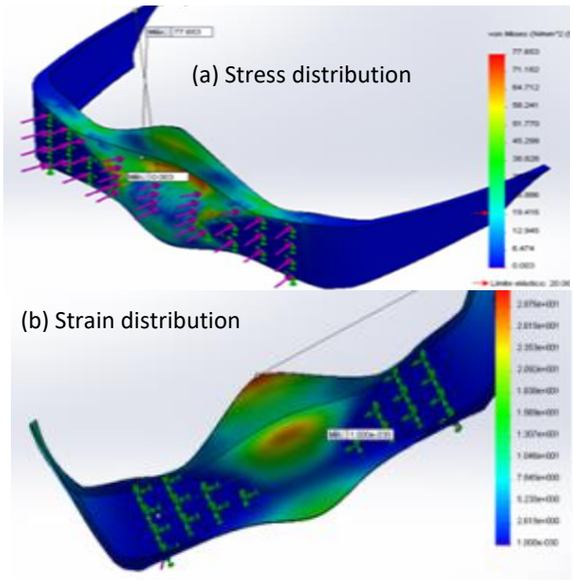

Figure 8 Impact results under conditions of Sim-1 (a) stress distribution (b) deformation distribution

Table 7 summarizes the maximum stress and strain values calculated according to the simulation conditions. The maximum stress for a layer of material is 87 MPa and a deflection of 14 mm. According to the results, the material fulfills with the conditions used in Model 2 and simulation conditions 1 and 2. However, under the conditions used simulation and thickness of model 1; the results shows that a layer of material could not satisfy the crash conditions.

	Impact maximum stress (MPa)	Maximum displacement generated by impact (mm)
Model 1 Sim-1	155	62.7
Model 1 Sim-2	232.97	94.1
Model 2 Sim-1	26.395	2.6
Model 2 Sim-2	39.592	3.98

Table 7 Results obtained from the simulation

Model 1 was built with a thickness of 3.17 mm, because the thickness of the MC-RY laminate was 1 mm, thus, three layers of composite material would be required for the construction of the bumper fascia proposed in Model 1. The results of the mechanical characterization of MC-RY with 3.17 mm thickness shows that the maximum resistance of the composite material would be 261 MPa, a greater stress than the calculated in the simulation.

Conclusions

The results from the mechanical characterization of the composite materials synthesized in this paper shows that both Jute fiber and the Manta fiber as reinforced are similar; for example, the Impact Energy was 2.43 J for the MC-RY and 2.14 J for the MC-RM.

The results from the simulation with the different forces and impact speeds indicated that in all cases the deformation and maximum stress generated in the bumper fascia does not exceed the values of the maximum stress, for the use of four layers of 3.17 mm, which is the thickness of a conventional bumper fascia and observed deformations for the MC-RY. These results suggest that the MC-RY obtained could be used for the construction of the automotive part, having qualities and low production cost adapting to the properties that are currently required in an automotive bumper fascia, such as its impact resistance, its deformation capacity, and adding qualities such as its capacity for environmental degradation and the availability of raw material in the market.

ISSN 2444-4928

Acknowledgements

The authors are grateful for the financial support provided by the Secretaría de Investigación y Posgrado of the Instituto Politécnico Nacional through Project SIP- 20211679.

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ISSN 2444-4928