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Dynamic Strain Analysis on a Passenger Car Bumper Body Material

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Abstract: *Car bumper is one of the main parts which are used as protection for passengers from front and rear collision. The aim of work is to suggest best car bumper material for modern cars. Dynamic analysis done by COSMOS according to the speeds of Federal Motor Vehicle Safety Standards, 208 that is 13.3 m sec-1 (48 km h-1).The materials used for bumper are steel, impact abs plastic and carbon fiber poly-ether-imide (PEI). In FEM analysis impact load was considered. Based on the strain values shown by above materials, the best material was found out.*

Keywords: *Bumper, Impact load, Collision, Dynamic analysis, strain.*

1. INTRODUCTION

An automobile's bumper is the front-most or rear-most part, ostensibly designed to allow the car to sustain an impact without damage to the vehicle's safety systems. They are not capable of reducing injury to vehicle occupants in high-speed impacts, but are increasingly being designed to mitigate injury to pedestrians struck by cars.

2. STANDARDS

Federal Motor Vehicle Safety Standard No. 215 (FMVSS 215), "Exterior Protection, the standard prohibited functional damage to specified safety-related components such as headlamps and fuel system components when the vehicle is subjected to barrier crash tests at 5 miles per hour (8 km/h) for front and 2.5 miles per hour (4 km/h) for rear bumper systems. New bumper standard was placed in the United States Code of Federal Regulations at 49CFR581 miles per hour (8 km/h) front and rear barrier and pendulum crash tests were required, and no damage was allowed to the bumper beyond a 3⁄8 in (10 mm) dent and 3⁄4 in (19 mm) displacement from the bumper's original position.

3. BUMPER MATERIAL CONSIDERATIONS

At one time, most car bumpers were made of steel, today car bumpers can be made from variety of different rubber materials or plastics molded sleekly around the front and back ends of the vehicles. Bumper systems usually include a reinforcement bar plus energy-absorbing material, such as polypropylene foam. The more a bumper extends from a car body, when other factors remain equal to the more it absorbs crash energy and reduces damage. The majority of modern plastic car bumper system fascia's are made of thermoplastic olefins (TPOs), polycarbonates,polyesters, polypropylene, polyurethanes, polyamides, or blends of these with, for instance, glass fibers, for strength and structural rigidity.

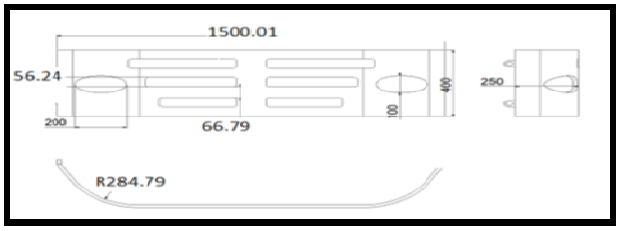


Fig. 12 2D Drawing of Bumper Body Modeling

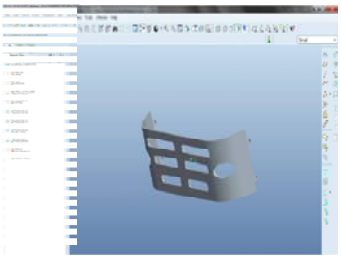


Fig. No: 1 3D Model

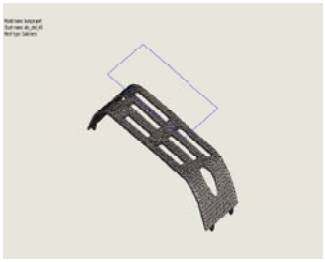


Fig. No: 2 3D Mesh

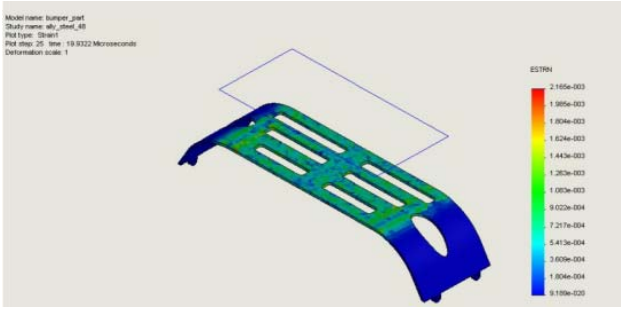


Fig. No: 3 Alloy steel @ 48

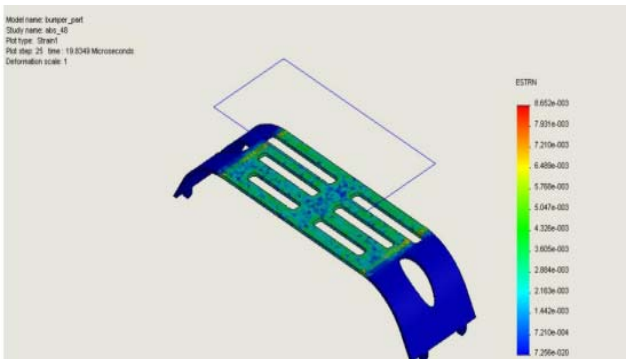


Fig. No: 4 Platic @ 48

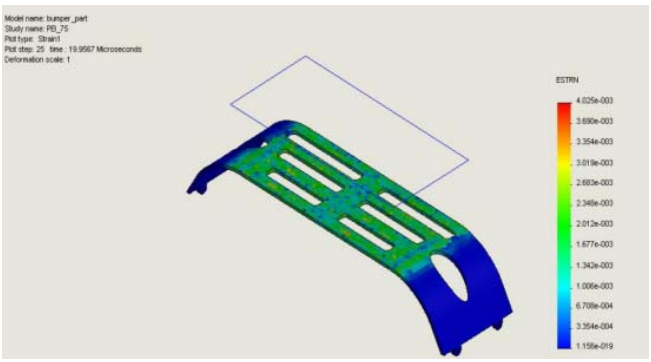


Fig. No: 8 PEI @75

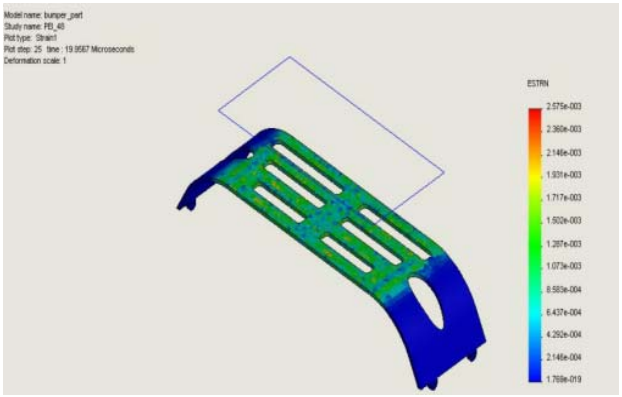


Fig. No: 5 PEI @48

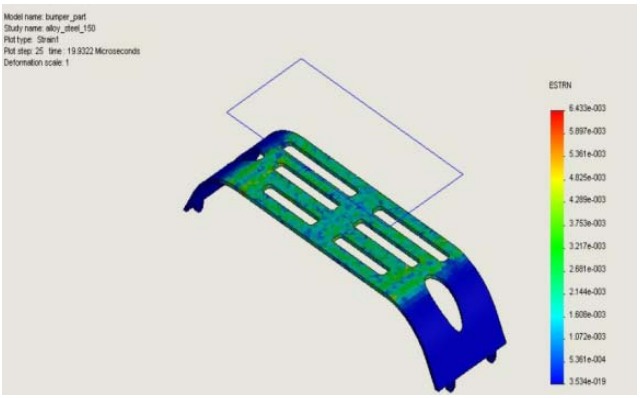


Fig. No: 9 Alloy steel @ 150

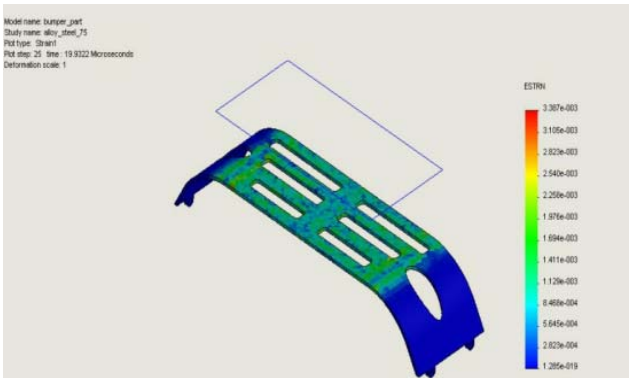


Fig. No: 6Alloy Steel @ 75

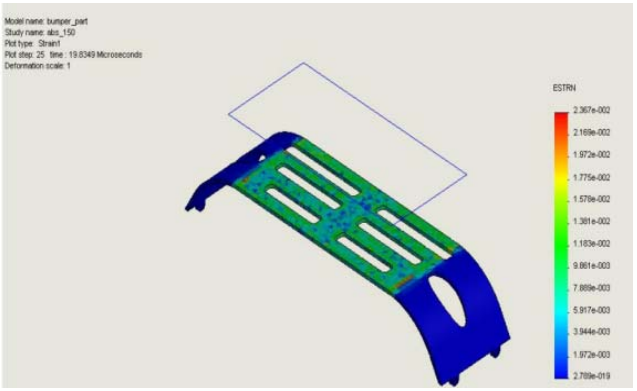


Fig. No: 10 Plastic@ 150

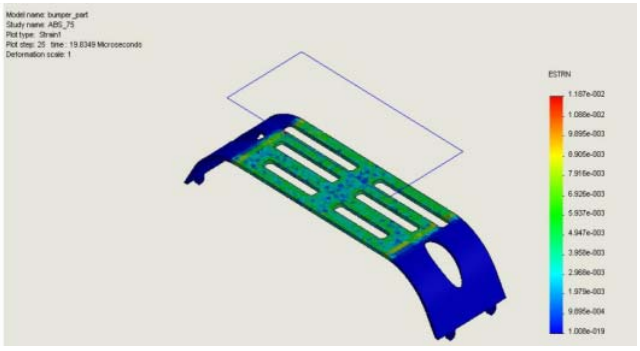


Fig. No: 7 Plastic @75

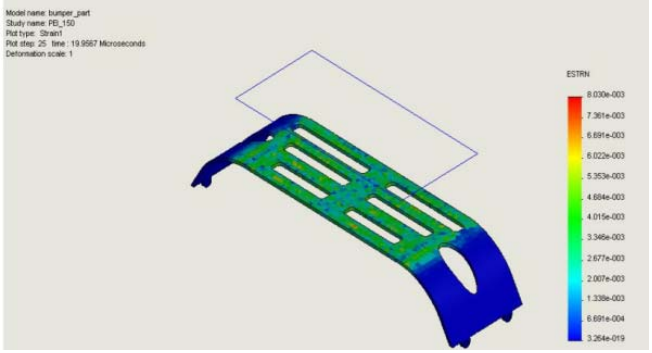
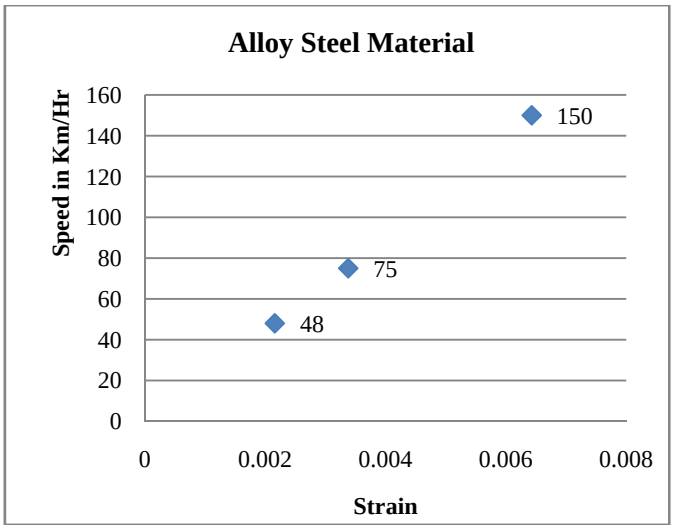
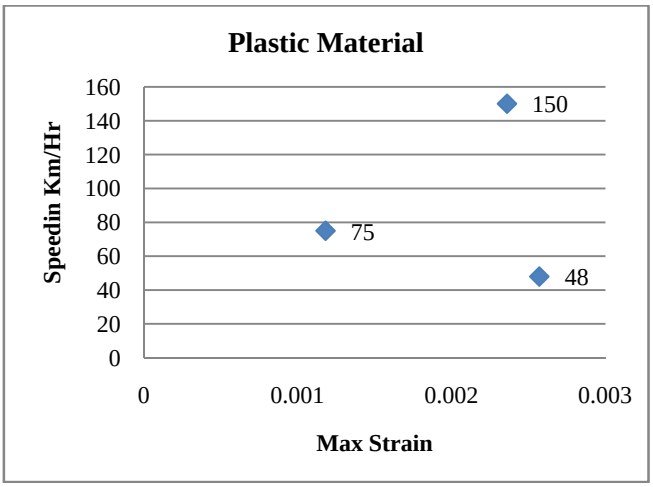


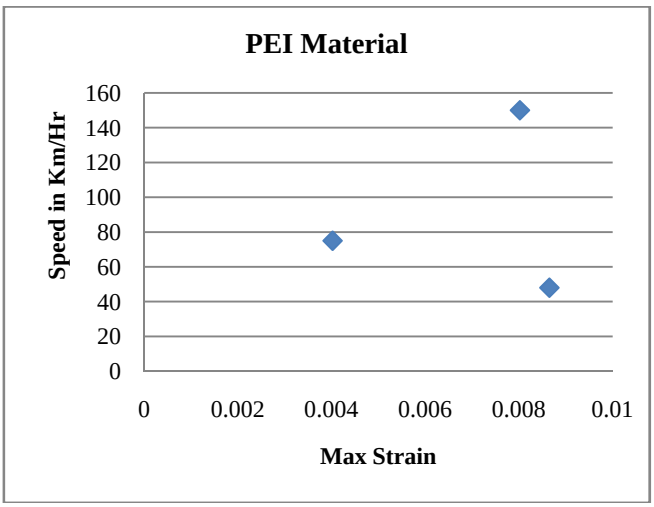
Fig. No: 11 PEI @150



Graph No: 1 Speed vs. Max Strain



Graph No: 2 Speed vs. Max Strain



Graph No: 3 Speed vs. Max Strain

4. CONCLUSION

By observing the strain analysis results, the minimum strain induced in the three materials is zero. The minimum strain occurred with nodal points of 8041where has maximum strain occurred with nodal points of 6554.when speed increased the strain the strain is also increased in case of alloy steels. The other two materials namely Plastic &PEI had shown inconsistent with increase of speed. Hence Alloy steel is suitable material against strain deformation.

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