Design and Analysis of Butterfly Valve

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Abstract: The main objective of this project is shape optimization and structural stability of the butterfly valve for metallic and nonmetallic materials butterfly valve is mostly used in the engine carburetors need to make structural stability and shape optimization plays the main role for this component, design modifications and material comparative analysis done in ANSYS Structural modules and find the optimized shape through stress, strain and deformation results

INTRODUCTION:

A butterfly valve is a shut-off valve with a relatively basic configuration. In the locked state, a disc covers the hole of the valves while in the available spot, the disc is rotated to allow the flow. A quarter turn takes the valve from fully open to fully closed or reverse location and thus the butterfly valve allows for easy opening and closing.

Butterfly valves may be used for a wide variety of applications in the areas of water supply, waste management, fire protection or gas supply, gas and oil industries, in fuel handling systems, power generation etc. Some of the benefits for this type of valve are the basic structure that does not take up too much room, and the light weight and lower cost relative to other valve designs.

The valves can be operated by means of handles, gears or actuators in conjunction with any particular need. The main objective of this project is shape optimization and structural stability of the butterfly valve for metallic and nonmetallic materials butterfly valve is mostly used in the engine carburetors need to make structural stability and shape optimization plays the main role for this component, design modifications and material comparative analysis done in ANSYS Structural modules and find the optimized shape through stress, strain and deformation results.

MODELING

Modeling of butterfly valve done in CATIA software and the modification is elliptical shape can be added in existing plate and elliptical shape is removed from the plate
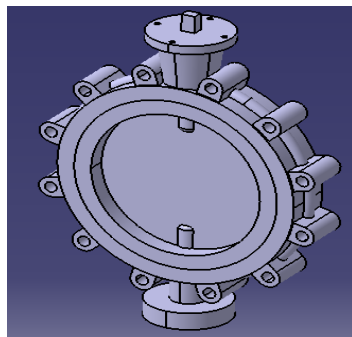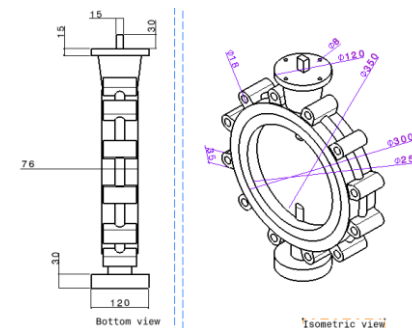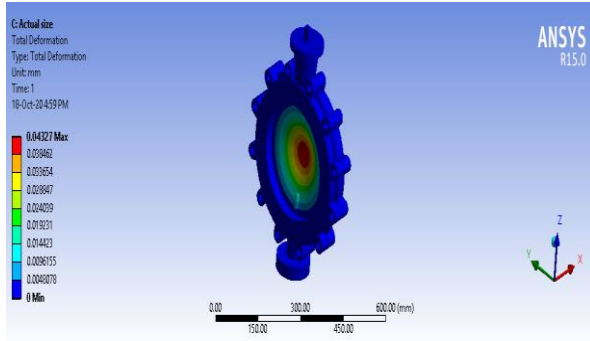

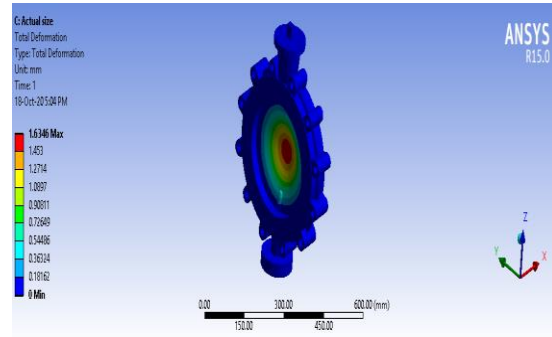**3D model of Butterfly valve**   **2D model of butterfly valve**

Results and discussion

TOTAL DEFORMATION
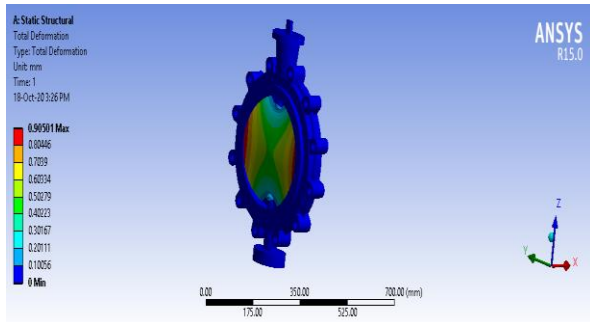
Actual size

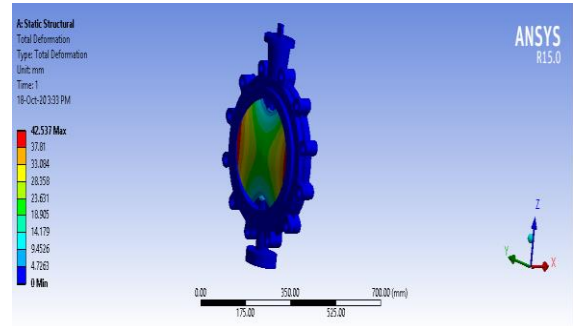Total deformation for aluminum alloy

Total deformation for polypropylene
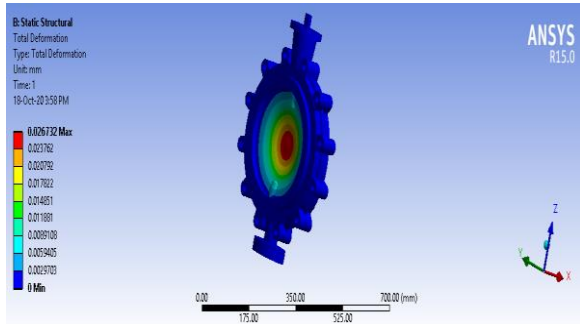
Modification 1
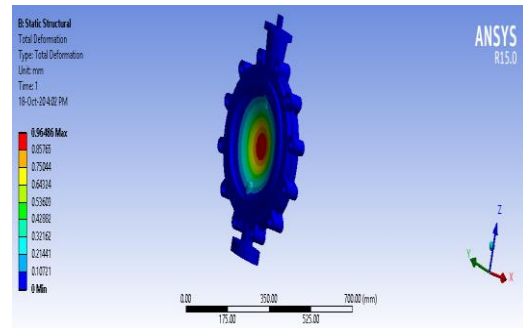

Total deformation for aluminum alloy
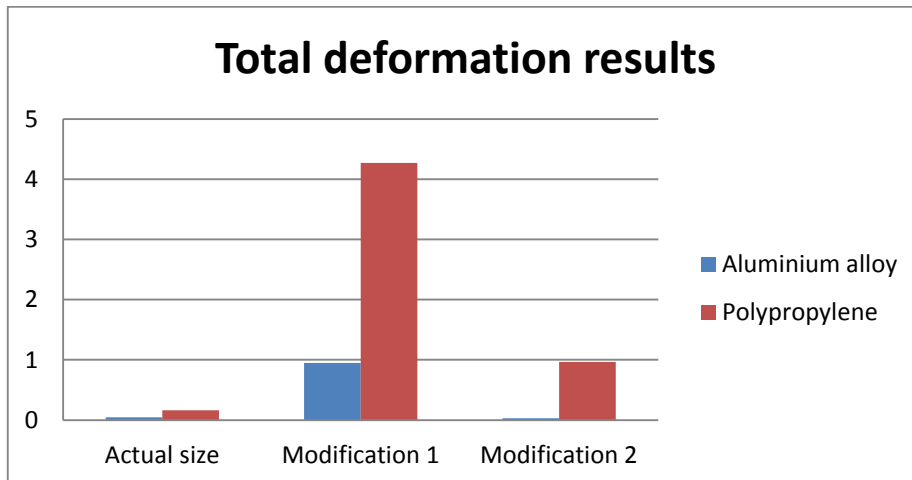

Total deformation for polypropylene

Modification 2

Total deformation for aluminum alloy

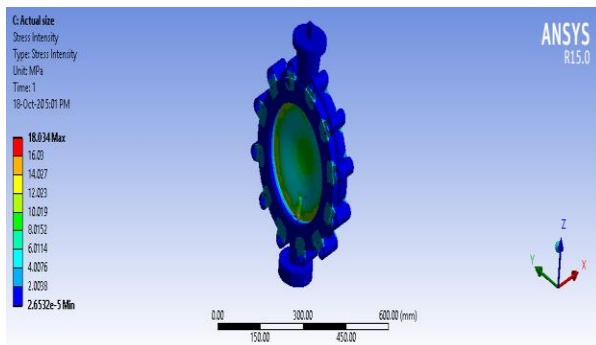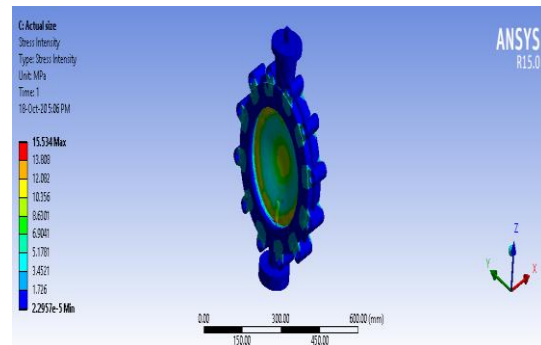Total deformation for polypropylene

Total deformation	Aluminum alloy	Polypropylene
Actual size	0.04327	0.16346
Modification 1	0.9501	4.27
Modification 2	0.026732	0.96486

STRESS INTENSITY
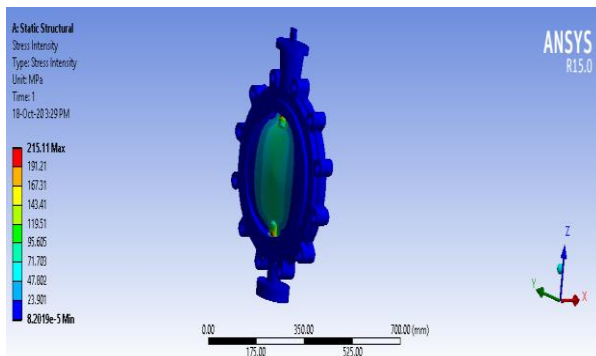
Actual size

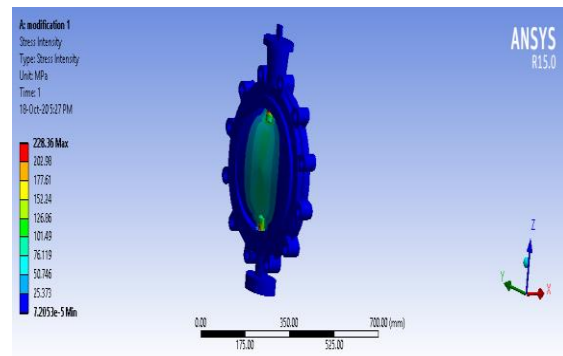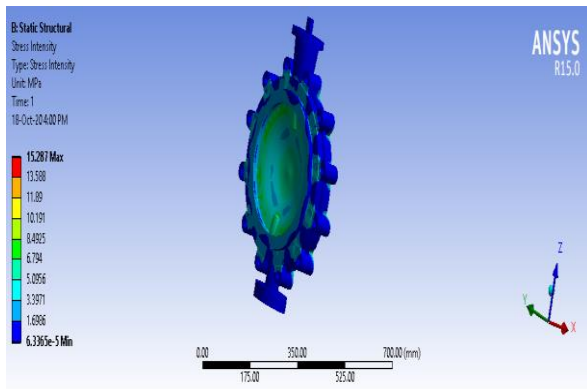Stress intensity for aluminum alloy   Stress intensity for polypropylene

Modification 1

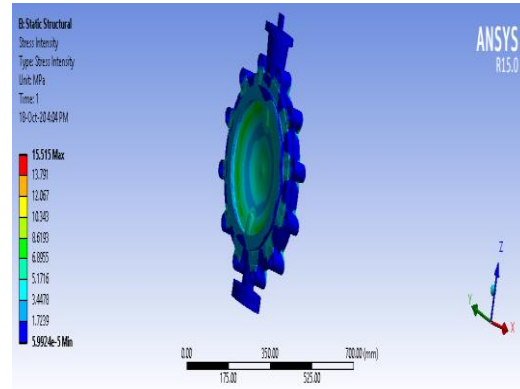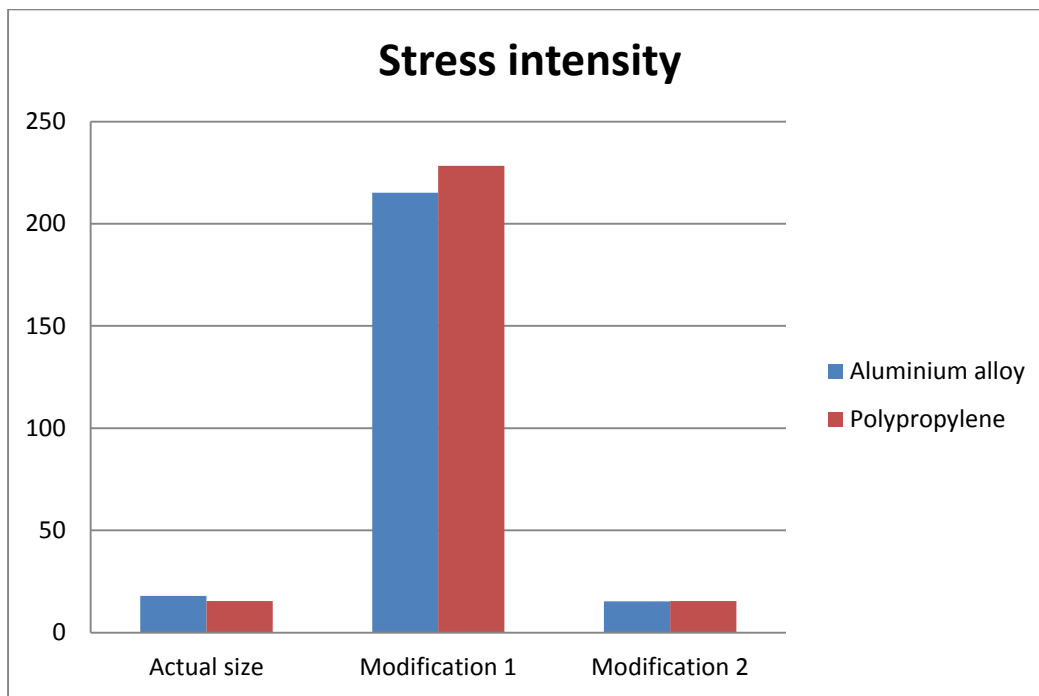Stress intensity for aluminum alloy   Stress intensity for polypropylene

Modification 2

Stress intensity for aluminum alloy

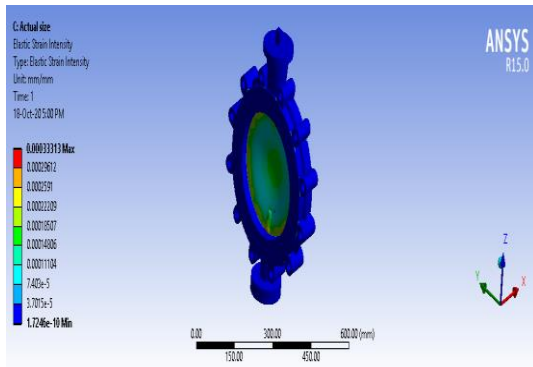Stress intensity for polypropylene

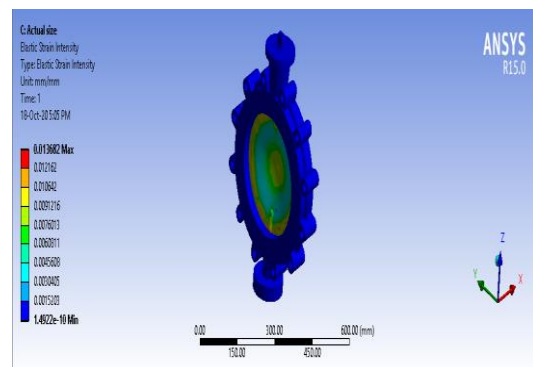| Stress intensity	Aluminum alloy	Polypropylene
Actual size	18.034	15.534
Modification 1	215.11	228.36
Modification 2	15.287	15.515

STRAIN INTENSITY
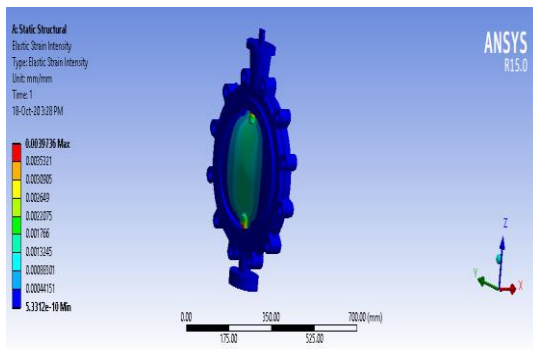
Actual size

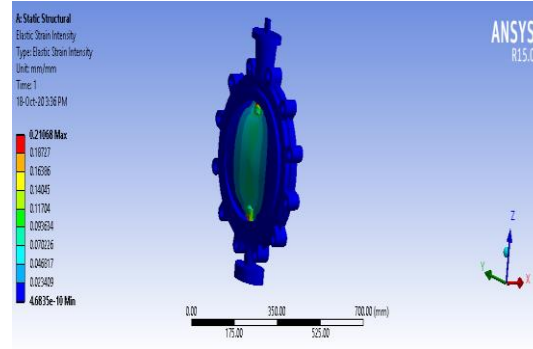Strain intensity for aluminum alloy

Strain intensity for polypropylene
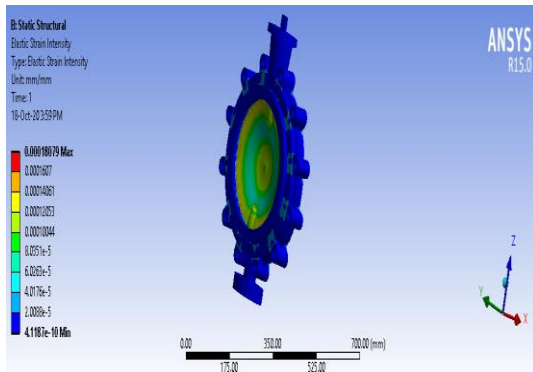
Modification 1

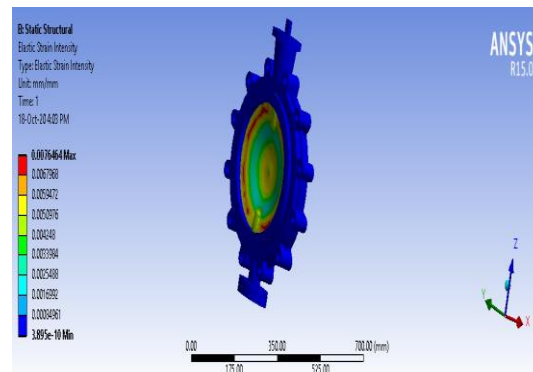Strain intensity for aluminum alloy
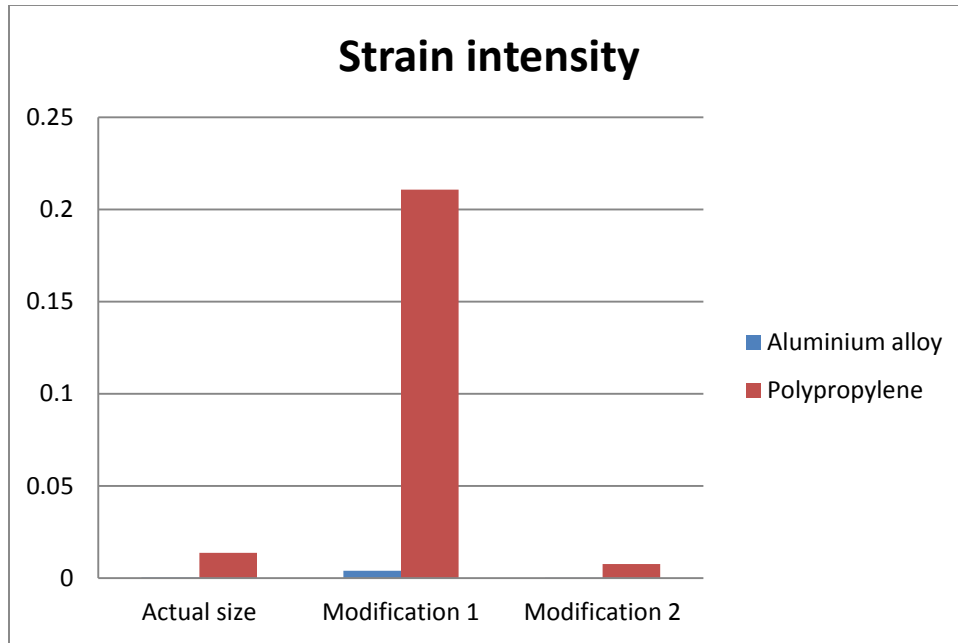

Strain intensity for polypropylene
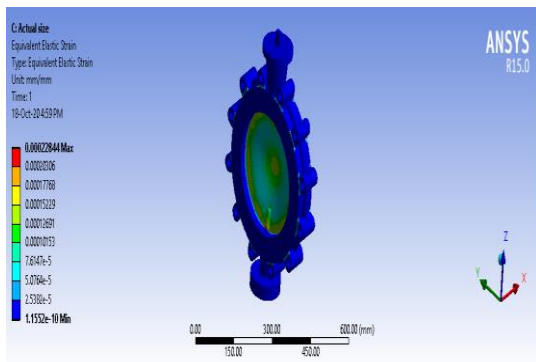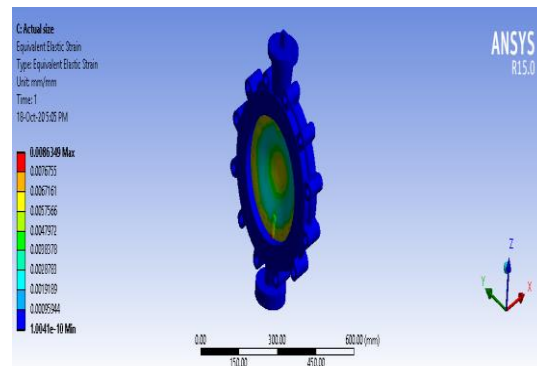
Modification 2

Strain intensity for aluminum alloy

Strain intensity for polypropylene

Strain intensity	Aluminum alloy	Polypropylene
Actual size	0.00033313	0.013682
Modification 1	0.0039736	0.21068
Modification 2	0.00018079	0.0076464

EQUIVALENT ELASTIC STRAIN

Actual size

Equivalent elastic strain for aluminum alloy

Equivalent elastic strain for polypropylene
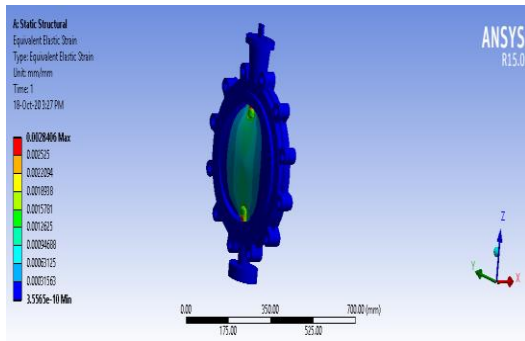
Modification 1

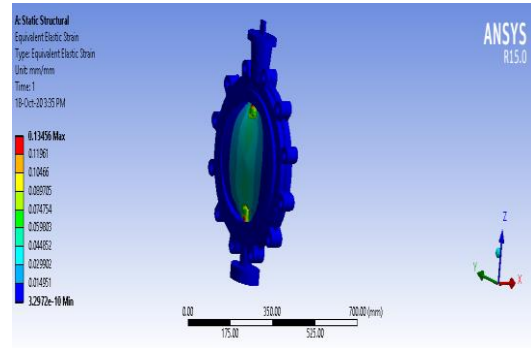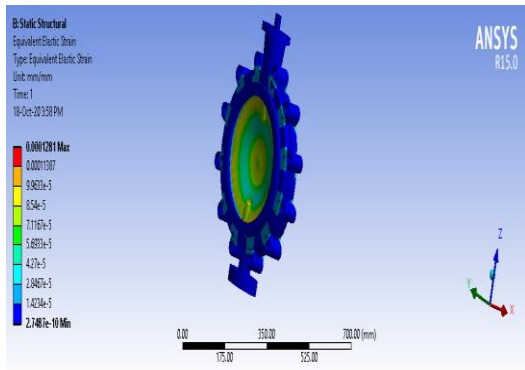
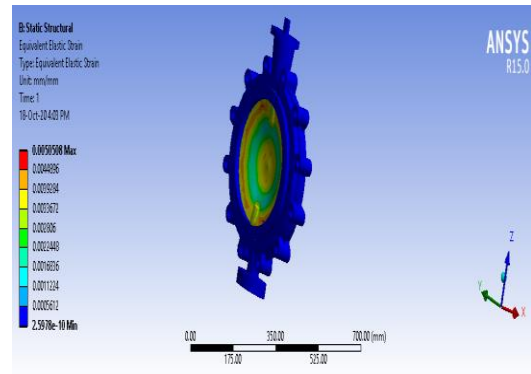Equivalent elastic strain for aluminum alloy

Equivalent elastic strain for polypropylene

Modification 2

Equivalent elastic strain for aluminum alloy

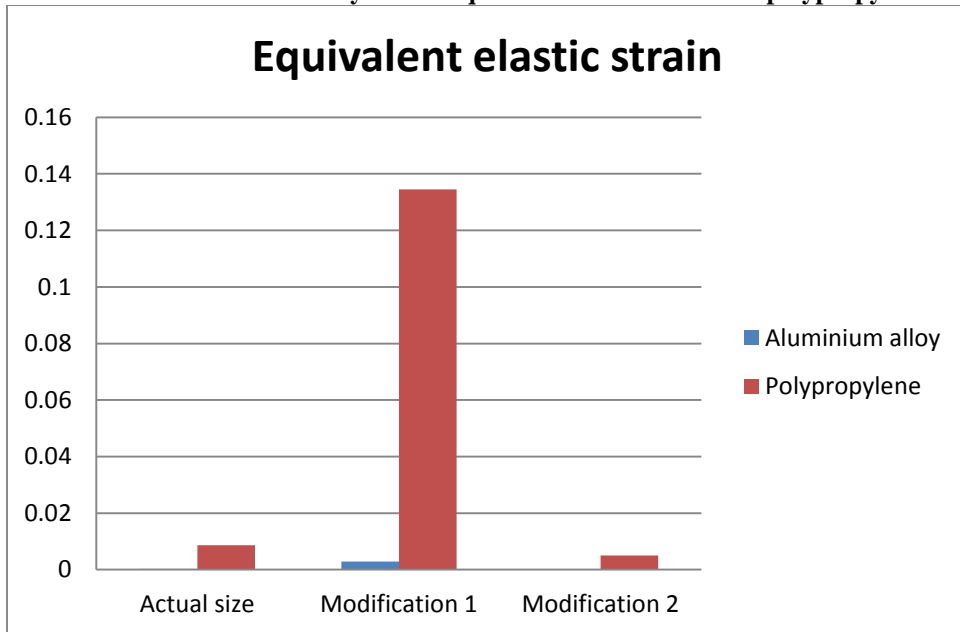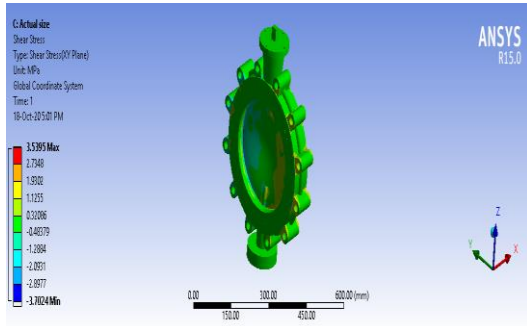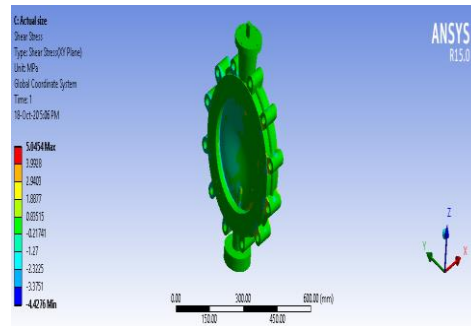Equivalent elastic strain for polypropylene

Equivalent elastic strain	Aluminum alloy	Polypropylene
Actual size	0.00022844	0.0086349
Modification 1	0.0028406	0.13456
Modification 2	0.0001281	0.0050508

SHEAR STRESS

Actual size

Shear stress for aluminum alloy

Shear stress for polypropylene

Modification 1

Shear stress for aluminum alloy

Shear stress for polypropylene

Modification 2

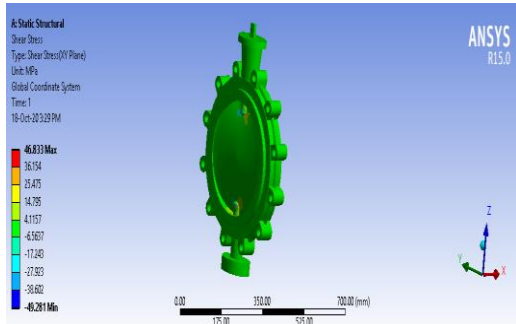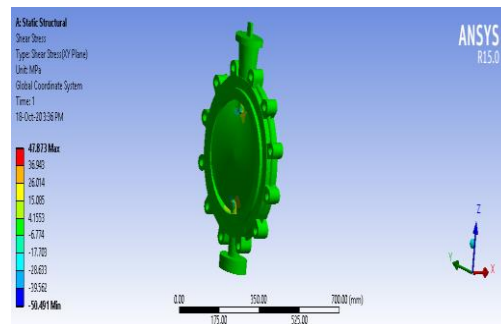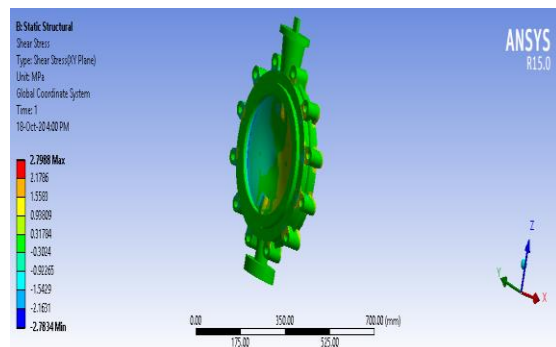**Shear stress for aluminum alloy**
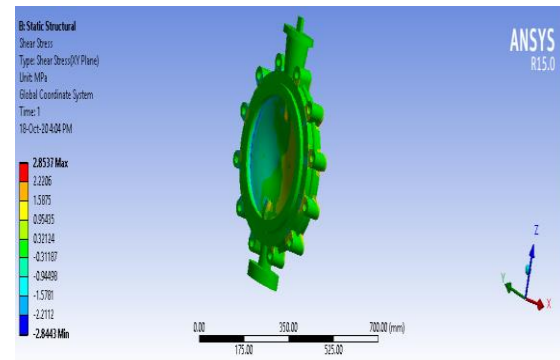
Shear stress for polypropylene
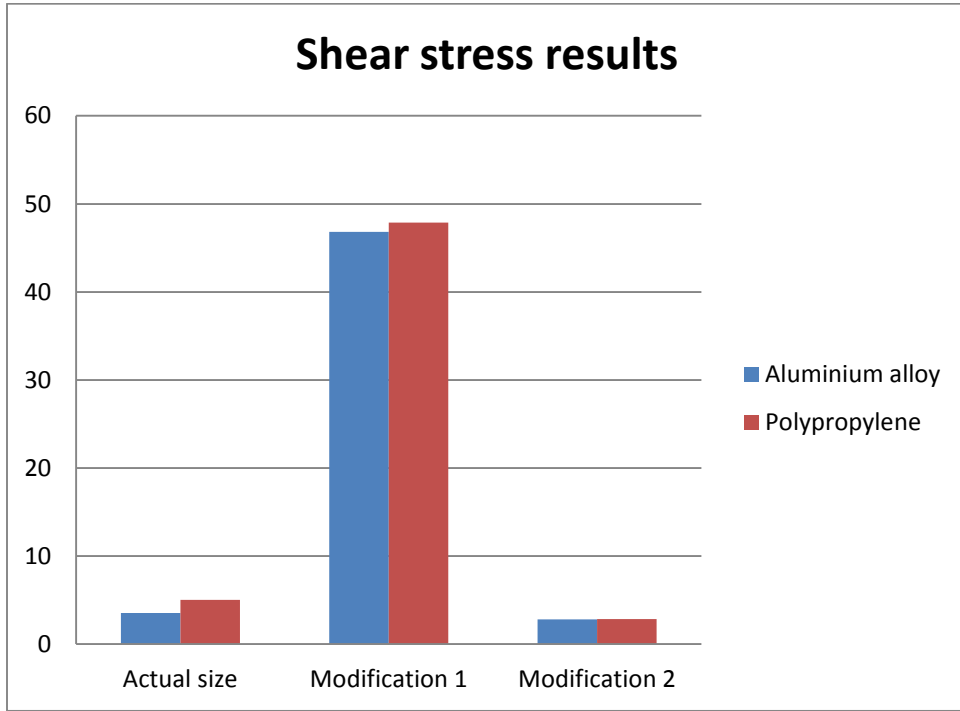
Shear stress	Aluminum alloy	Polypropylene
Actual size	3.5395	5.0454
Modification 1	46.833	47.873
Modification 2	2.7988	2.8537

Equivalent stress

Actual size
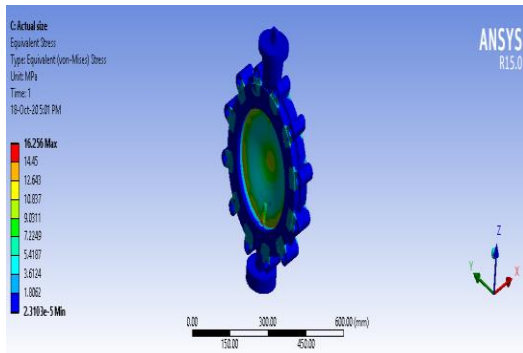
Equivalent stress for aluminum alloy
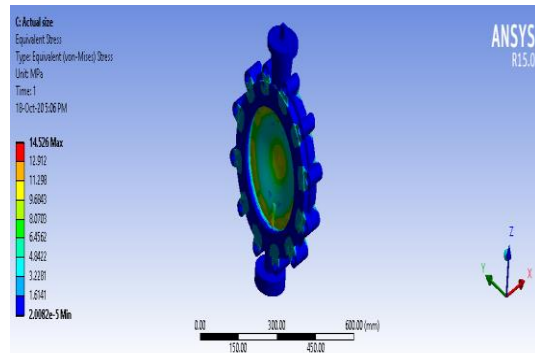
Equivalent stress for polypropylene

Modification 1

Equivalent stress for aluminum alloy

Equivalent stress for polypropylene

Modification 2

Equivalent stress for aluminum alloy

Equivalent stress for polypropylene

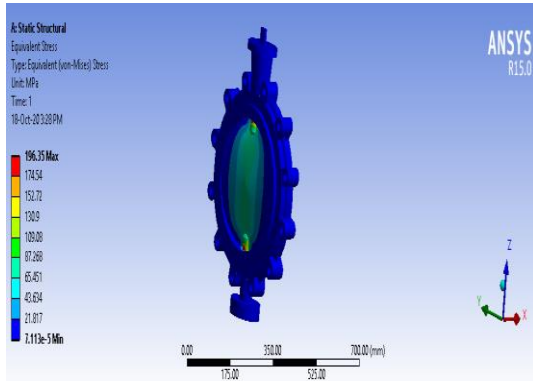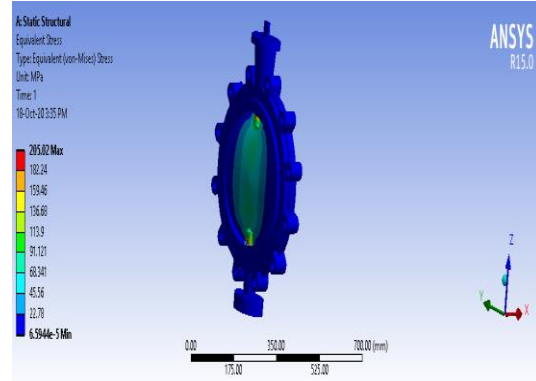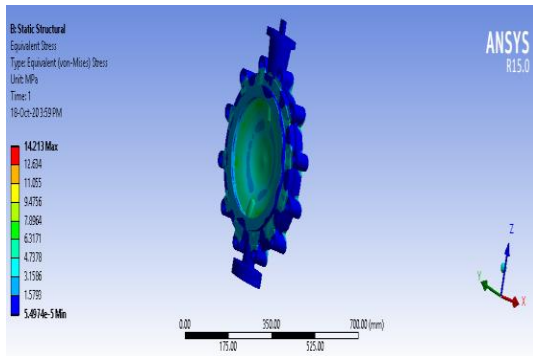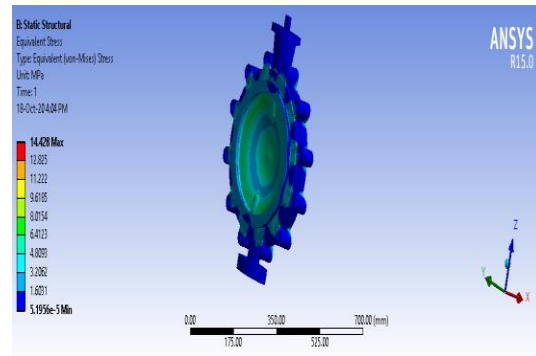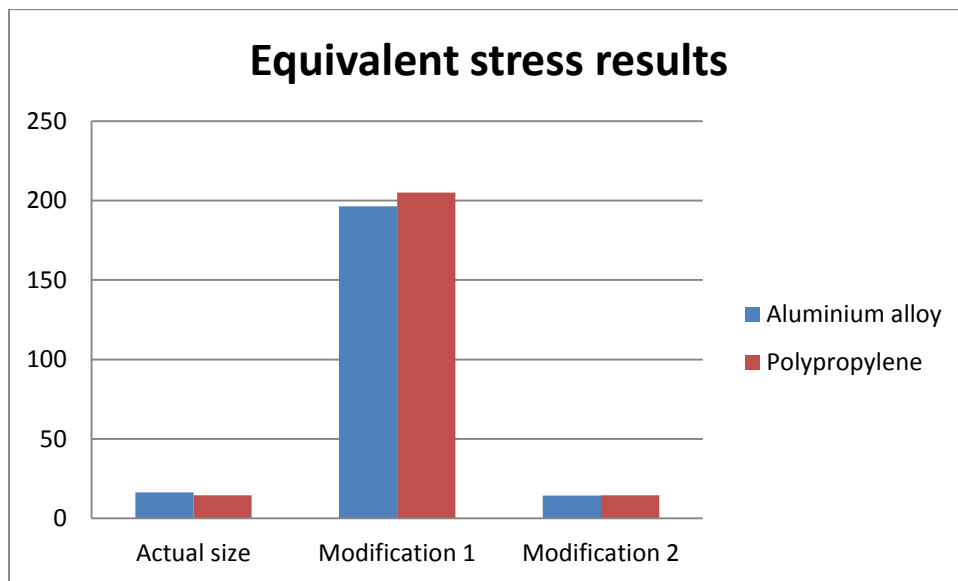| Equivalent stress	Aluminum alloy	Polypropylene
Actual size	16.256	14.526
Modification 1	196.35	205.02
Modification 2	14.213	14.428

Conclusion:

The butterfly valve result analysis results show the structural deformations and stress in the valves, now a days plastic valves are used for replacement of metallic valves, in this analysis polypropylene material show the better results compare to the aluminium alloy, adding the elliptical structure modifications give the better results in both materials and structural stability also

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9. Ogawa, K. and Kimura,T. Hydrodynamic characteristics of a butterfly valve – prediction of torque characteristic. ISA Trans., 1995, 34, 327–333. Proc. IMechE Vol. 223 Part E: J. Process Mechanical Engineering JPME236 © IMechE 2009 Downloaded from pie.sagepub.com at DONG A UNIV LIBRARY on July 11, 2011 Analysis and optimization of butterfly valve disc 89.
10. Huang, C. D. and Kim, R. H. Three-dimensional analysis of partially open butterfly valve flows. Trans. ASME, J. Fluids Eng., 1996, 118, 562–568.