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Modelling and Analysis of Ball Valve with Various Materials

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Abstract: The purpose of the study is to layout and examination of ball valve with various materials including the substitution of existing material and the mechanical properties of the valve material which is used to control of the smooth movement at various speeds. The present material is sketched out and examination is finished and differentiated and the proposed material.

Key words: Ball valve, mechanical properties, materials, various speed, smooth movement, value

INTRODUCTION

The metallic seat has the like hood to slide in the drag dealt with in the body. A ring of, Viton with hardeners (glass, carbon) is crushed into the seat (Kamkar and Basavaraddi, 2015; Chern and Wang, 2004; Shen *et al*., 2008). Fragile settling material meets the considerable seal with a straightforward dealing with under run of the mill temperatures (Bagherifard *et al*., 2013). For the adequate quality (Jayakumar *et al*., 2014; Rajesh *et al*., 2017), the blueprint must be established on a tally system supplemented by an exploratory arrangement procedure or test arrange methodology without calculation if the after effect of the most outrageous appropriate weight PS and the volume V is under 6000 bar×L or the thing PS×NPS is under 2500 bar. The ball valve was showed in Fig. 1.

Materials used in analysis of this component: The ball valve is designed with a dimensions of the existing model with the help of SolidWorks Software and analysed in the ansys software with the various materials the analysis include normal elastic strain, normal stress and total deformation.

MATERIALS AND METHODS

The ball valve was created in the SolidWorks Software by the correct dimensions of the presently used ball valve. After the 3D Model creation it is imported to the ANSYS WorkBench Software then it is analysed. The static structural analyse is chosen for this model to find the mechanical efficiency of the ball valve.

Designing of ball valve: Figure 2 shows the solid model of the ball valve is showed. The solid model was created by the SolidWorks Software by correct dimension of the currently used ball valve. This 3D Model was created in the sldprt format. After the completion of the design it was converted to step file for importing to ANSYS.

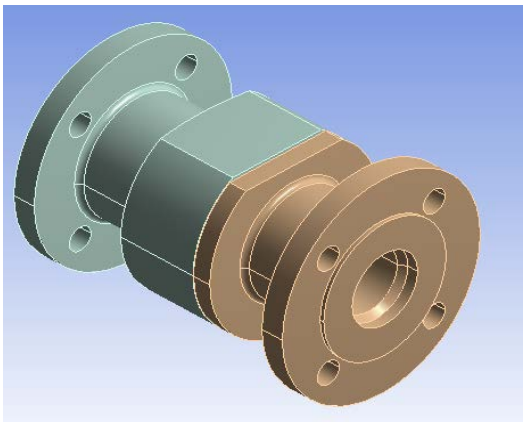

Fig. 1: Image of ball valve

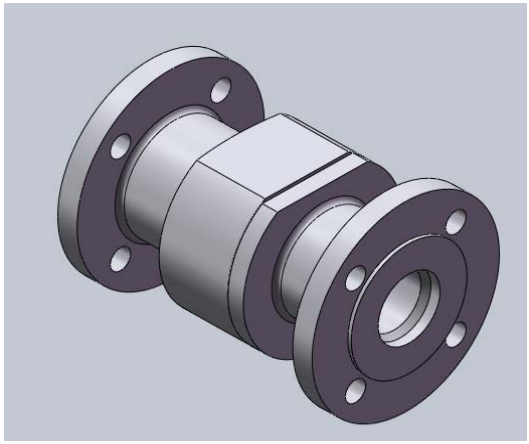

Fig. 2: 3D Model of the ball valve

Meshing of ball valve: The meshing is the important step in the ANSYS. In the meshing step, the model was divided as the more elements. The division is helps for getting accurate result. Figure 3 shows the smooth mesh which was created from ANSYS Software.

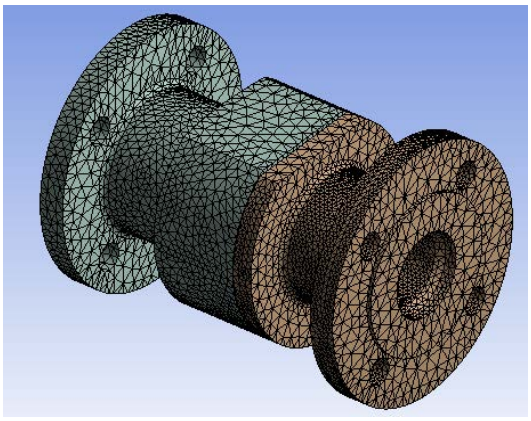

Fig. 3: Meshing of the ball valve

Analysis of ball valve: The results by the static structural analysis are shown in Fig. 4-6. The normal elastic strain of the ball valve was shown in Fig. 4. By the give load condition the ball was safe elastic strain.

The stress value is the important one for every component. Figure 5 shows the normal stress values of the ball valve. By the result the ball valve has safe stress value due to the load condition.

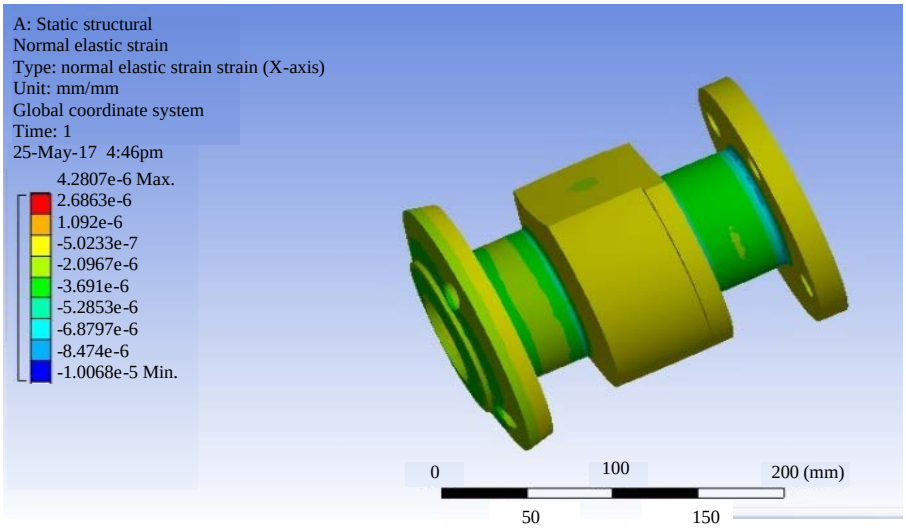

Fig. 4: Normal elastic strain

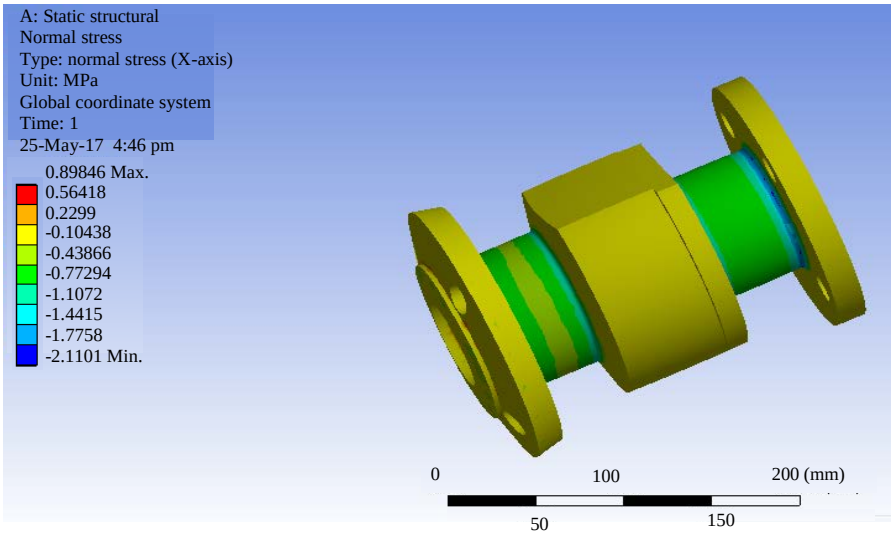

Fig. 5: Normal stress

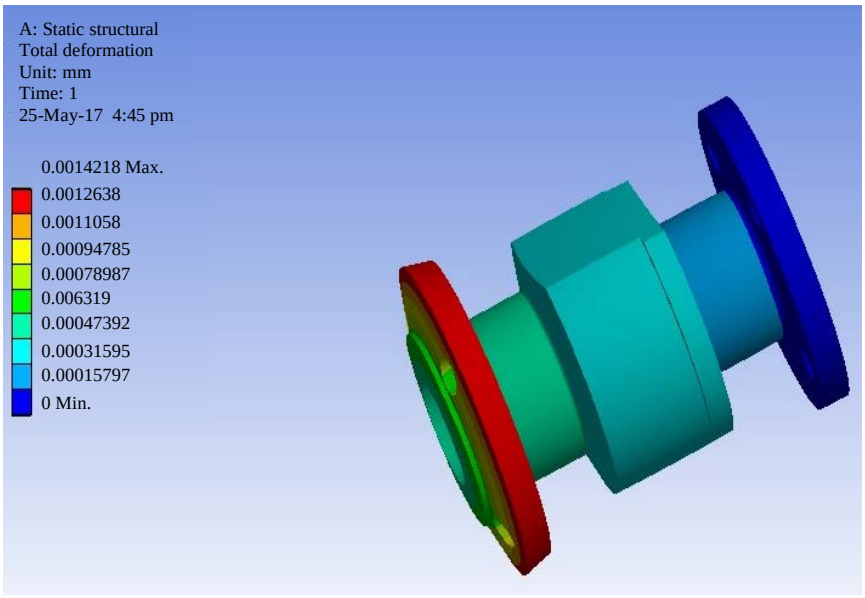

Fig. 6: Total deformation

Table 1: Existing properties of ball valve

Properties	Values
Material	Cast iron
Volume	5420.14 (mm³)
Co ordinates type	Cartesian
Mass	3.23e-003 (kg)
Nodes	189
Elements	230

Table 2: Properties of proposed material

Material	SAE 2458
Density	23.21 (g/cm³)
Yield strength	65 (Mpa)
Compressive strength	600 (MPa)
Modulus of elasticity	745 (GPa)
Vickers hardness	3212
Thermal conductivity	0.78

Figure 6 shows the total deformation value of the ball valve. Deformation property is important property for the components. The deformation was classified as two types, one was total deformation and another one was directional deformation. By the result the left side of the ball valve has crictical level due to the boundary conditions. The existing material properties are given in the Table 1 and 2.

RESULTS AND DISCUSSION

Table 3 shows the stress, displacement and sliding contact values of three various components. The materials are cast iron, stainless steel and brass. The three materials are compared with each other. From the Table 3, it is clear that the cast iron have the high stress and lover displacement compared to the other two materials

Table 3: Analysis result

	Results		
Material	Stress	Displacement	Sliding contact
Cast iron	16.25	0.121e-3	0.741e-5
Stainless steel	9.82	0.254e-3	0.210e-4
Brass	12.00	0.964e-3	0.136e-4

analysed here. By the comparison of these three materials the cast iron is the best material to manufacture the ball valves.

CONCLUSION

The ball valve solid model was successfully created by the SolidWorks Software. And the created solid model was statically analysed by the ANSYS WorkBench Software. Three various materials are used to analysis the ball valve casting. And the analysed results are compared with each other. By the comparison of the obtained values of stress and deformations it is clear that the cast iron have the better mechanical character than other two materials, so, it is the most suitable material for casting the ball valve casing.

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