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"ANALYSIS OF CONNECTING ROD BY USING DIFFERENT MATERIALS THROUGH ANSYS"

Alok Kumar [1], Ashish Parkhe [2]
[1] *M.Tech. Scholar, Dept. of Mechanical Engineering, NIIST, Bhopal, MP, India*
[2] *Assistant Professor, Dept. of Mechanical Engineering, NIIST, Bhopal, MP, India*

ABSTRACT

Connecting rod, an important link between piston and crank shaft in an IC Engines. It is used for transfer the power from piston end to crank end and it also convert reciprocating motion into rotary motion. Connecting rod has two ends one is pin end and other is crank end. This paper presents the analysis of connecting rod by using different materials through ANSYS 18.1. 3D Model of the connecting rod is created by using UNIGRAPHICS-NX10 and simulated using ANSYS 18.1 software which is based on the finite element method (FEM). The study is carried out on the effect of the max. force on the Bajaj discover 150cc bike's connecting rod. In this project we use Structural Steel S460, Al 6061 Alloy & Epoxy S- Glass UD composite. Finally, comparisons between these materials are carried out at stresses and deformations level. Then we have found out Epoxy S- Glass UD composite is best suited material than other materials along with the less mass. The result obtained could be further utilized to design an optimized connecting rod.

Keyword: *Structural Steel S460, Al 6061 Alloy, Epoxy S- Glass UD composite, connecting rod, Stresses, Deformation,,UNIGRAPHICS, ANSYS.*

I. INTRODUCTION

The connecting rod does this essential task of changing over responding energy of the chamber into rotational energy of the crankshaft. It contains an upper forked portion which fits on the crosshead bearings while the lower part fits on the crankpin bearing. With this barely game-plan there is intensely overwhelming hub stacking on the connecting rod which accomplishes its peak at the upper ideal in light of the fact that the gas pressure and the inertial powers facilitate to increase the general power. Other erratic working conditions, for instance, chamber seizure and passing augmentation in zenith pressure can withal bring about astringent addition in accentuate on the con-rod and it could bomb due to fastening as a result of these powers. Unremarkably connecting rods are produce made and the material used is consistently delicate and medium carbon steel. The terminuses where the rod is related with the X-head or crankpin have bearings which are made out of white metal working surface and shims (thing packings) are habituated to roll out the required improvements. There are four shocks at each affiliation point which benefit for get together and impression of the connecting rod, and are fixed to their required torque utilizing water driven jack.

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Fig. 1.1 Connecting Rod

II. OBJECTIVES

- The principle target of this examination is to explore the quality conduct of the connecting rod during the motor activity. The well ordered goals are as following:
- A geometrical model for connecting rod in Solid edge.
- To check whether connecting rod material takes the thermal stress instigated because of gas load.
- To check whether connecting rod material takes the deformation actuated because of gas load.
- To check whether connecting rod material takes the temperature instigated because of gas load.
- To check whether connecting rod material takes the warmth motion instigated because of gas load.
- Investigate the greatest stress of connecting rod utilizing ANSYS for the most pessimistic scenario for example at the point when greatest force is following up on connecting rod.

III. PROBLEM FORMULATION

Disappointment of a connecting rod, ordinarily called "tossing a rod" is one of the most predominant reasons for cataclysmic motor disappointment in bicycles and vehicles, much of the time putting the messed up rod through the side of the crankcase and in this manner rendering the motor hopeless; it can result from weakness almost a physical deformity in the rod, oil disappointment in a bearing because of flawed support, or from disappointment of the rod jolts from an imperfection, untimely fixing.

IV. MODELING OF CONNECTING ROD

Fig 4.1 Front View of as built connecting rod of Bajaj discover 150cc model

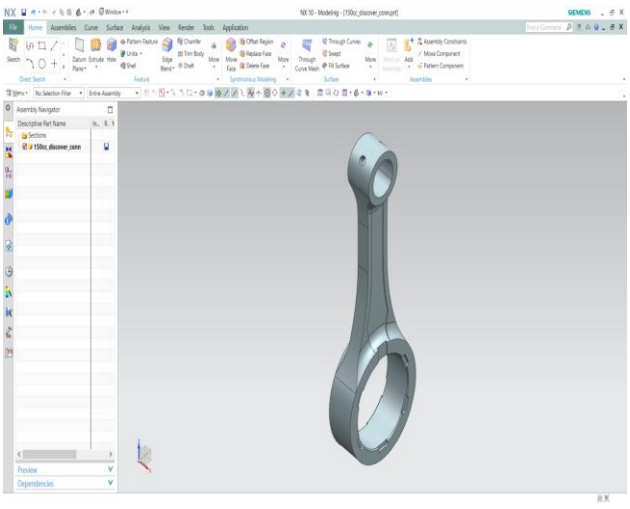

Fig 4.2 Model of connecting rod on Siemens NX

The above figure is showing connecting rod of Bajaj discover 150cc model which is modeled with the help of Siemens NX software.

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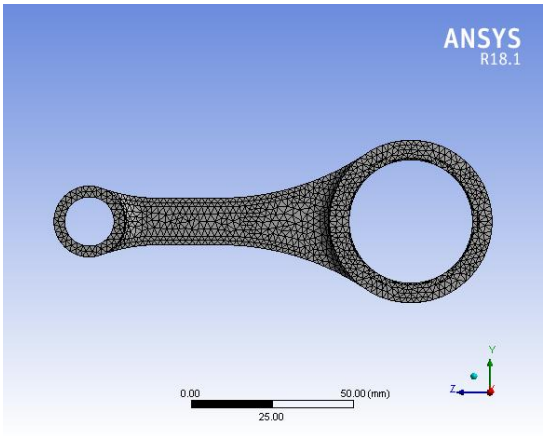

Fig 4.3 Connecting rod model after meshing in ANSYS 18.1

The above figure is showing the meshing of connecting rod which is common for all materials. Here, we have use tetrahedron type mesh element with number of nodes 49076 and number of elements 30945.

4.2 SIMULATION

4.2.1 Structural steel (S460)

Equivalent (von misses) stress for

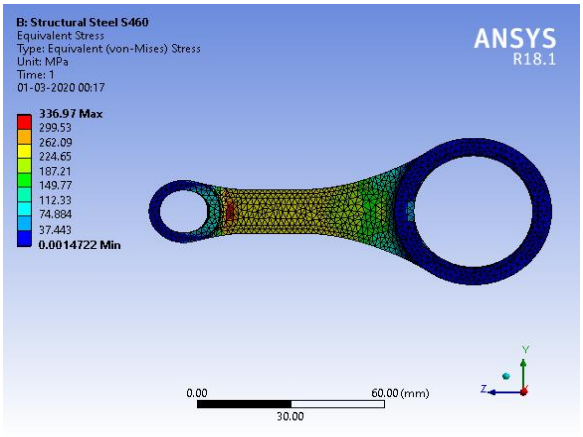

Fig 4.4 Structural Steel S460 material Equivalent (von misses) stressTotal Deformation for Structural steel (S460)

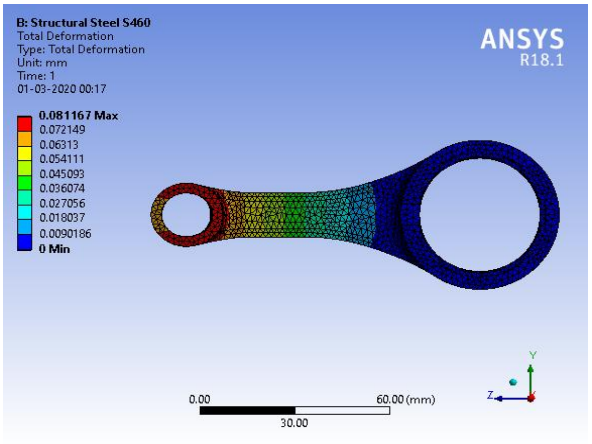

Fig 4.5 Structural Steel S460 material Total Deformation

4.2.2 Al6061 Alloy

Equivalent (von misses) stress & Total Deformation for Al6061 Alloy

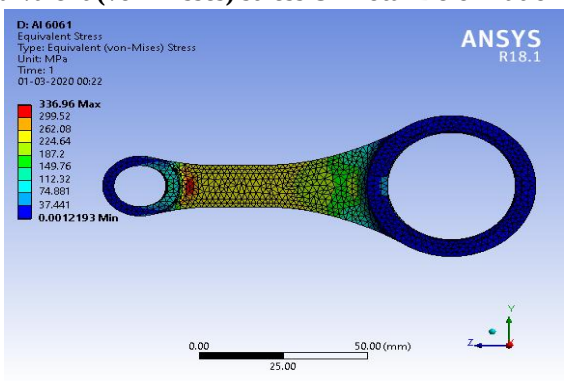

Fig 4.6 Al6061 Alloy material Equivalent (von misses) stress

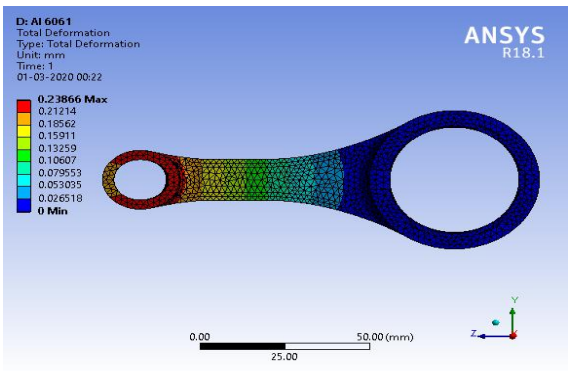

Fig 4.7 Al6061 Alloy material Total Deformation

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4.2.3 Epoxy S-Glass UD composite

Total Deformation for Epoxy S-Glass UD composite

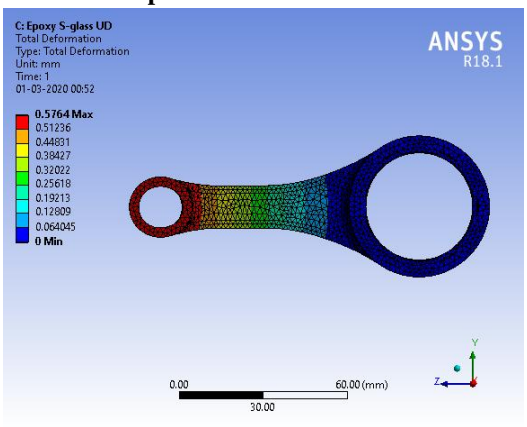

Fig 4.8 Epoxy S-Glass UD composite material Total Deformation

V. RESULT & DISCUSSION

Table.1 Stress Comparison between different materials

Sr. No	Materials	Equivalent Von - Misses stresses (MPa)	Limiting Stress (MPa)
1	Structural Steel S460	336.97	460 (Yield Strength)
2	Al 6061 Alloy	336.96	276 (Yield Strength)
3	S Glass fiber	305.97	1000 (Ultimate Strength)

The above table is showing the Equivalent Von misses stresses result for all materials like Structural Steel S460 (336.97 MPa), Al 6061Alloy (336.96 MPa) and Epoxy S Glass UD Composite (305.97 MPa) Hence it is cleared from the above table the factor of safety in case of Epoxy S Glass UD Composite materials is more as compared to all among chosen materials and Epoxy S Glass UD Composite materials has less value of stresses with different materials and its considerable limiting range.

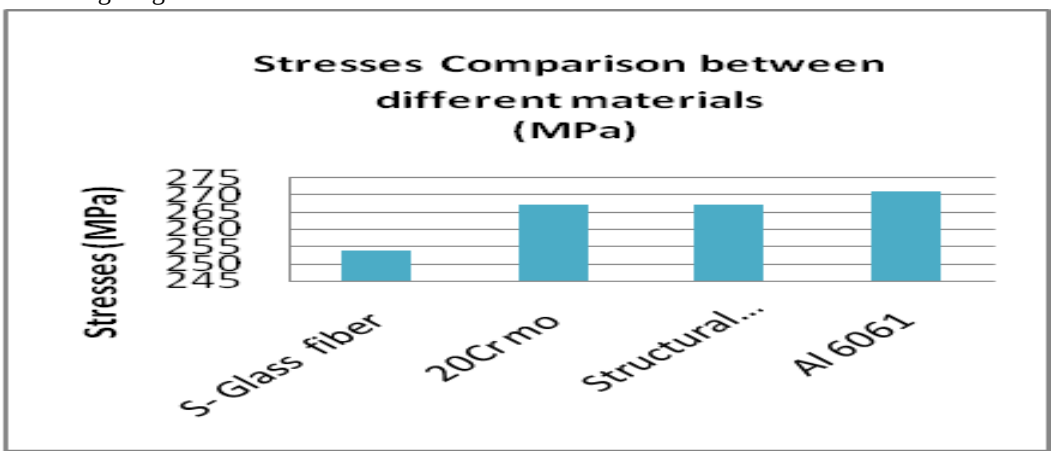

Fig. 5.1 Stresses Comparison between different Materials (MPa)

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Table 5.2 Deformations Comparison between different materials

S. No	Materials	Deformations (mm)
1	Structural Steel S460	0.0811
2	Al 6061 Alloy	0.2386
3	Epoxy S- Glass UD Composite	0.576

The above table is showing the deformation result for all materials like Structural Steel S460 (0.0811 mm), Al 6061Alloy (0.2386 mm) and Epoxy S Glass UD Composite (0.576 mm) Hence it is cleared from the above table Epoxy S Glass UD Composite materials has more value of deformation with different materials and its considerable limiting range because these are maximum deformation which comes out at maximum stress application though it would be less in the actual condition. Here we can see that Epoxy S- glass UD composite materials have value of materials and its considerable range.

5.2 DISCUSSION

Epoxy S-Glass UD Composite materials has more estimation of warmth motion with various different materials. So it is alright for future arrangement based on more worth warmth transition so here primary target this venture discovers more worth warmth motion. So we can recommended S-Glass carbon fiber materials for connecting rod in future. Since it is light weight and tough materials. This exploration undertaking examined weight and cost
decrease openings that steel fashioned connecting rods offer. This Project is focused on the estimation of the stresses created in the connecting rod and to discover district progressively vulnerable to failure. The connecting rod picked for the examination is of 4 stroke single chamber motor in which failure of the connecting rod brings about the substitution of the entire connecting rod crankshaft get together. FEA was performed utilizing these outcomes acquired from burden analysis to pick up an understanding of the basic conduct of connecting rod and to decide configuration loads for further examination. First the CAD Modeling of connecting rod with the assistance of Cad programming Siemens NX and after that Load analysis was performed with various cases thought. The analysis was completed with PC helped recreation. The apparatus utilized for analysis in ANSYS WORKBENCH R18.1.

VI. CONCLUSION

In this work, finite element analysis of connecting rod was completed by utilizing ANSYS simulation instrument. Arrangement of simulations was done to comprehend the impact of material determination in connecting rod configuration by thinking about various materials. Wide scope of varieties were seen in the greatness of Equivalent von-mises stresses, Equivalent flexible strain, Total deformation and Factor of safety for various materials. It is found that Epoxy S-Glass UD Composite materials is best suited among all chosen materials. It's weight is less as compared to others which will help in overall cost saving when it is produced in massive scale

VII. FUTURE SCOPE

Further changes in the structure of connecting rod can be made like choosing some other segment other than the I type such as H type or + type. Further analysis is conceivable by selecting distinctive materials for the connecting rod such as alloys or composite whose strength is better than the existing one. Analysis of weight decrease and cost analysis should also be possible. Most extreme stresses comes out at below the small end of connecting rod so further study will also be focus on that particular area of the connecting rod. Chamfering of sharp boundaries of connecting rod likewise helps in decreasing the stress level and expands quality of the connecting rod. Dynamic analysis of connecting rod should also be possible and different elements of disappointment can be considered.

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REFERENCES

1.Roy, D. R. B. K. "Plan Analysis and Optimization of Various parameters of Connecting Rod utilizing CAE programming." International Journal of New Innovations in Engineering and Technology 1.1 (2012): 52-63.
2.Shenoy, Pravardhan S., and Ali Fatemi. "Interfacing pole streamlining for weight and cost decrease." No. 2005-01-0987. SAE Technical Paper, 2005.

3.Yogesh. B. Dupare, Raju.B.Tirpude and Akshay.Y.Bharadbhunje. "Exhaustion examination in associating bar utilizing ansys."International Journal of Modern Trends in Engineering and Research, Volume 02, Issue 02, February - 2015.

4.Vegi, Leela Krishna, and VenuGopalVegi. "Plan and examination of associating bar utilizing produced steel." International Journal of Scientific and Engineering Research 4.6 (2013): 2081.

5.Joshi, Prateek, and Mohammad UmairZaki. "FEM examination of associating pole of various materials utilizing ANSYS." International Journal of Engineering and Techniques 3.1 (2015).

6.Kumar, Amit, P. P. Bhingole, and Dinesh Kumar. "Dynamic Analysis of Bajaj Pulsar 150cc Connecting Rod Using ANSYS 14.0." Asian Journal of Engineering and Applied Technology (2014): 19-24.

7.Bhargav, I. Sai, M. PavanKalyan, and N. Charishma. "Structure and Comparative Analysis of Connecting Rod Using Composite Materials." International Journal of Engineering in Advanced Research Science and Technology 4 (2015).

8.Taware, RavirajYashwant, and AbhayArunUtpat. "Examination of Connecting Rod Used in Two Wheeler under Static Loading by FEA."International Journal of Engineering Trends and Technology (IJETT) – Volume 20 Number 1 – Feb 2015.

9.Kuldeep B, Arun L.R, Mohammed Faheem. "Examination and improvement of interfacing pole utilizing ALFASiC composites." International Journal of Innovative Research in Science, Engineering and Technology, Vol. 2, Issue 6, June 2013.

10.Mahipal Manda1, Ramesh Kola2 , K Karunakarreddy3. "Modular Analysis of a Connecting Rod utilizing ANSYS"SSRG I nternational Journal of Mechanical Engineering (SSRG-IJME) – volume 4 Issue 4–April 2017

11.Naman Gupta1, Manas Purohit2, Kartik Choubey3 "Current Optimized Design Analysis of Connecting Rod of an Engine" International Research Journal of Engineering and Technology (IRJET) , Volume: 05 Issue: 02 | Feb-2018

12.Vinayak Chumbre1 , Vinayak Kallannavar2 , Anilkumar Shirahatti3 , Ratan Patil4 , Shirish M. Kerur5" Design and Comparative Analysis of Connecting Rod utilizing Finite Element Analysis:" International Journal for Research in Applied Science and Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887 Volume 6 Issue IV, April 2018

13.Webster, W. D., Coffell R., and Alfaro D, "A Three Dimensional Finite Element Analysis of a High Speed Diesel Engine Connecting Rod," SAE Technical Paper Series, Paper No. 831322, 1983

14.Repgen, B., "Streamlined Connecting Rods to Enable Higher Engine Performance and Cost Reduction," SAE Technical Paper Series, Paper No. 980-882, 1998

ISSN : 2455-9679
Impact Factor : 3.340

15.Park, H., Ko, Y. S., Jung, S. C., Song, B. T., Jun, Y. H., Lee, B. C., and Lim, J. D., "Improvement of Fracture Split Steel Connecting Rods," SAE Technical Paper Series, Paper No. 2003-01-1309, 2003

16.Sarihan, V. furthermore, Song, J., "Enhancement of the Wrist Pin End of an Automobile Engine Connecting Rod With an Interference Fit", Journal of Mechanical Design, Transactions of the ASME, Vol. 112, PP. 406-412, 1990

17.Hippoliti R ,"FEM Method for Design and Optimization of Connecting Rods for Small Two-Stroke Engines", Small Engine Technology Conference, pp. 217-231, (1993)

18.Biradar Akshaydatta Vinayakrao, Prof. Swami M. C.," Analysis and Optimization of Connecting Rod utilized in Heavy Commercial Vehicles" IJEDR | Volume 5, Issue 3 | ISSN: 2321-9939, 2017