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Design and Thermal Analysis of IC Engine's Connecting Rod for Different Heat Conditions

BOGA SUDHA, Dr. I SATYANARAYANA, C.SIVAKANDHAN
bogasudha.dns@gmail.com, Master of Technology Student
, isnmechprofessor@gmail.com ,M.Tech (IIT-KGP), Ph.D., MIE, MISTE, MISHMT
kandhansiva69@gmail.com ME, Ph.D., MISTE, FIE, Professor in Mechanical Engineering
M.Praveen Kumar, pravee314@gmail.com Asst.professor
Sri Indu Institute Of Engineering & Technology

Abstract- The connecting rod is the intermediate between the piston and the crankshaft. It transfer the rotary motion of crank to reciprocating motion of piston in cy1inder.In this project, the comparison is takes place for the best material between Carbon steel & Aluminum alloy. The connecting rod is modeled in 3D modeling software knows as Solid works. Then these designs are carried for thermal analysis. This thermal analysis is done in a software calls Ansys. By thermal analysis we can get the heat flux values & by that we can select the best material for connecting rod.

Keywords: 3D modeling, Thermal Analysis, Ansys, Heat Flux.

1. INTRODUCTION

In a reciprocating piston engine, the connecting rod connects the piston to the crankshaft to convert the reciprocating motion of piston to rotary for crank. It is fastened to the piston at its small end, by a piston pin, also known as a gudgeon pin. The big end is attached to the crankshaft at the crankpin journal.

Together with the crank, they form a simple mechanism that converts linear motion into rotating motion. The purpose of a connection rod is to provide fluid movement between pistons and a crankshaft.

2. LITERATURE REVIEW

VenuGopal Vegi and Leela Krishna Vegi: In their paper describe designing and analysis of a connecting rod. Currently existing connecting rods are made of carbon steel. Finite element analysis is carried out on a connecting rod made of forged steel. The parameters like Von mises stress, strain, deformation, factor of safety etc were calculated and found that forged steel have more factor of safety, reduced weight, greater stiffness than carbon steel. Pravardhan S.Shenoy and Ali Fatemi: They carried out the dynamic load analysis and optimization of connecting rod.

The main objective of this study was to explore weight and cost reduction opportunities for a production forged steel connecting rod. Change in the material, resulting in a significant reduction in machining cost. The structural factors considered for weight reduction during the optimization include the buckling load factor, stresses under the loads, bending stiffness, and axial stiffness. Cost reduction is achieved by using C-70 steel. It eliminates sawing and machining of the rod and believed to reduce the production cost by 25%.Dr. N. A. Wankhade, Suchita Ingale:

The connecting rod is designed in Catia. To analyses the bending stress using Ansys on each material. To plot the results for bending stress acting on Structural steel, Al7075, Al6061 and high strength carbon fiber and comparing this with bending stress acting on materials. The connecting rod of high strength carbon fiber suffers lesser and thus can be best suited for connecting rod of diesel engine.

3. OBJECTIVE

The objective is to design connecting rod using Solid works and carry out the thermal analysis using Ansys. Thus we get to know convective heat transfer coefficient and temperature distribution on connecting rod. A transient therma1 analysis determines the same under conditions that vary over a period of time.

4. SOLIDWORKS

Aim is to design a connecting rod using Solid works. This is a combination of different parts. Each and every part will design in solid works and then assembled to form a connecting rod.

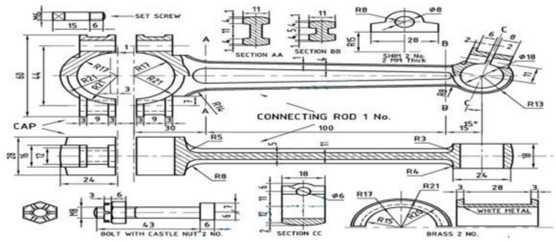


Fig.1 design a connecting rod using Solid works

Connecting rod shank body

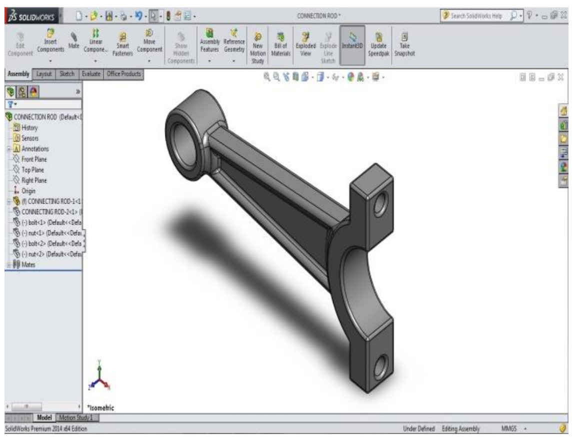


Fig.2 Top Cover

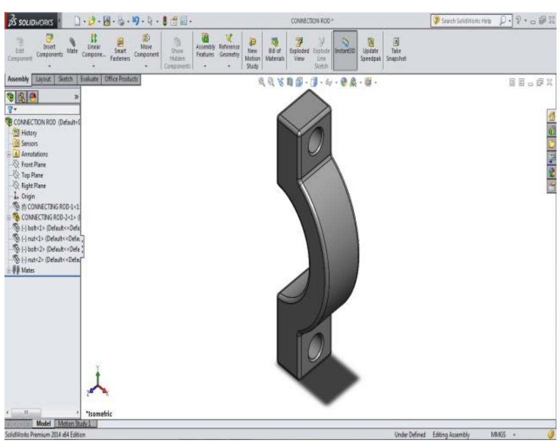


Fig.3 Front Cover

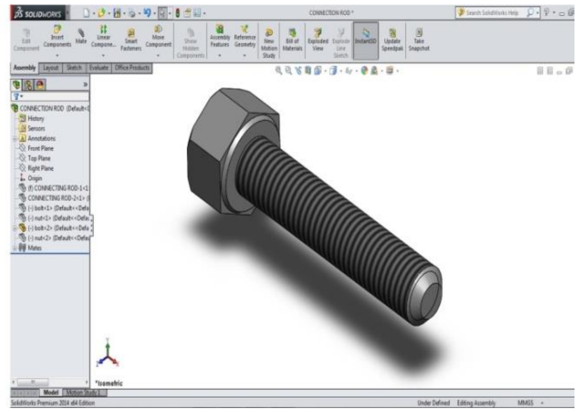


Fig.4 BOLT

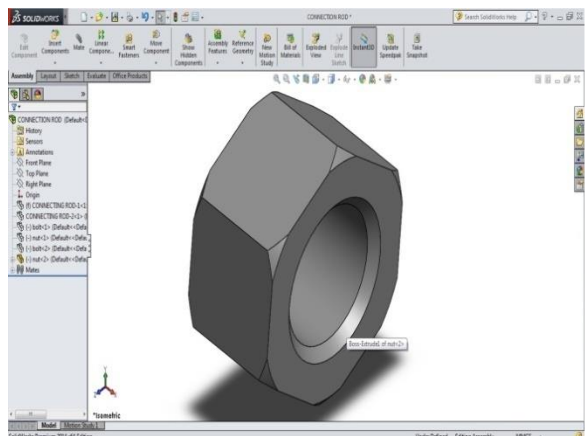


Fig.5 NUT

Connecting Rod Assembly:

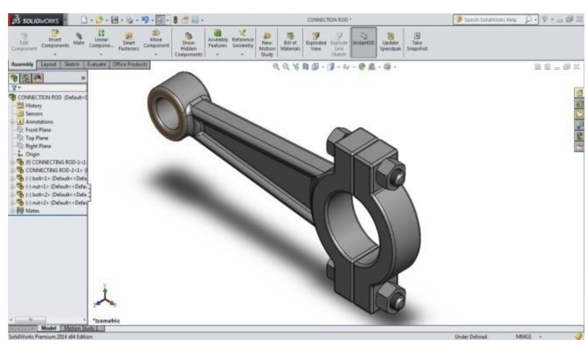


Fig.6 Connecting Rod Assembly

ANSYS:

Thermal analysis: Thermal analysis decides temperatures and other amounts that differ with temperature after some time. The variety of temperature conveyance after some time is of enthusiasm for some applications, for example, with cooling of electronic package or an extinguishing examination for heat treatment.

5. MODEL ANALYSIS

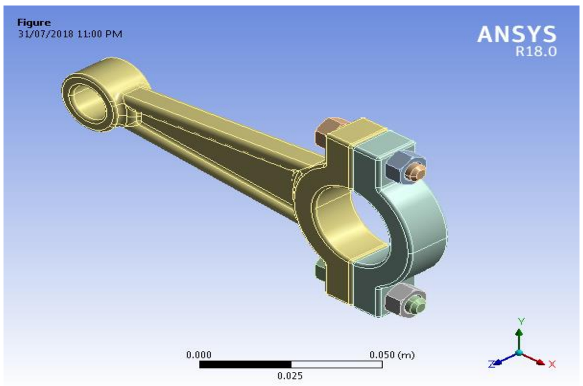


Fig.7 Ansys Model

Mesh

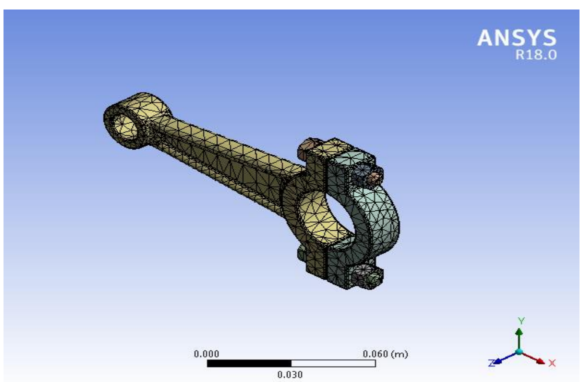


Fig. 8 Mesh Analysis

Steady-state thermal analysis

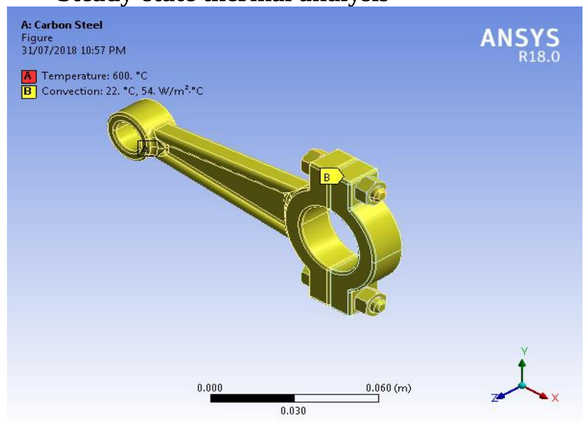


Fig.9 Temperature Analysis

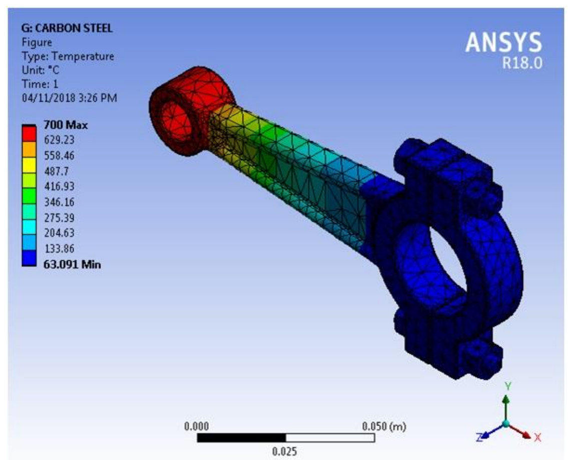


Fig.10 Temperature Analyzed

Total Heat Flux

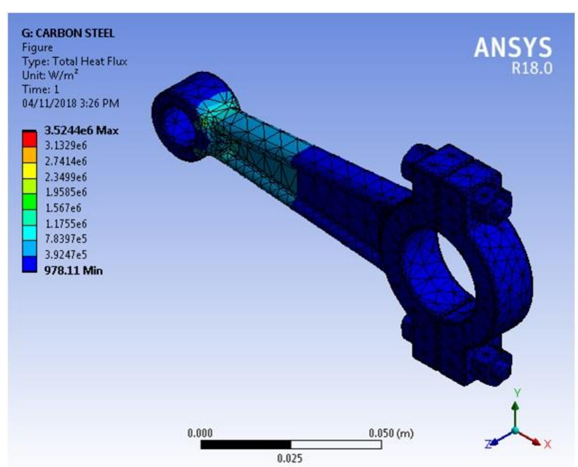


Fig.11 Total Heat Analysis

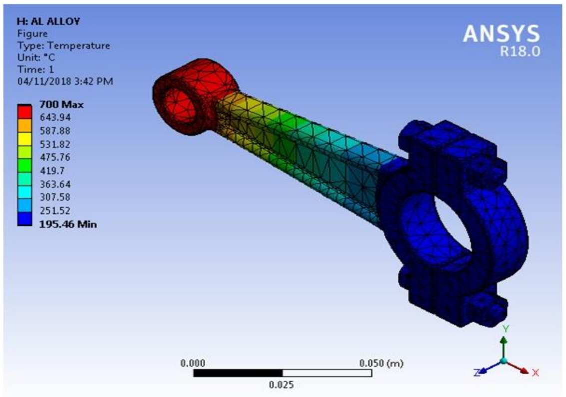
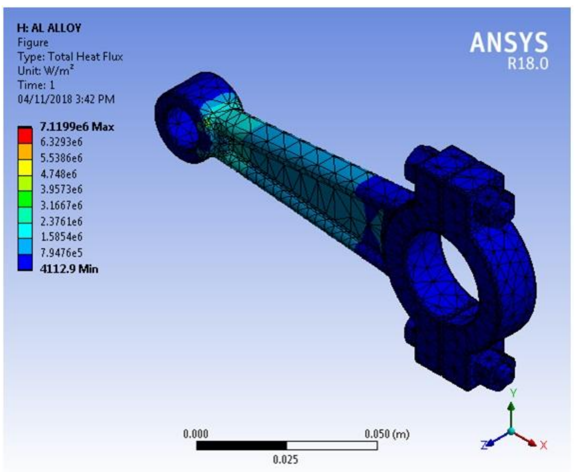


Fig.12 Temperature Analysis



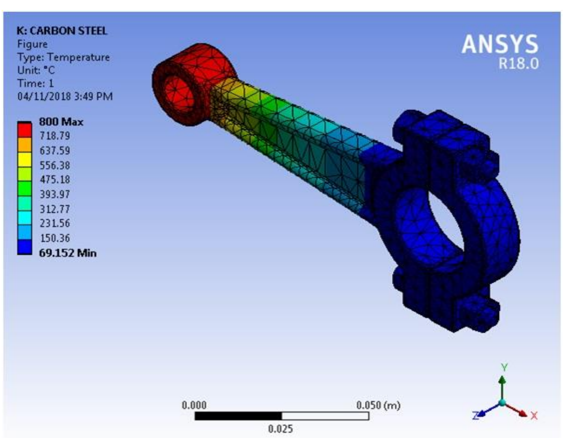


Fig.13 Temperature Analysis

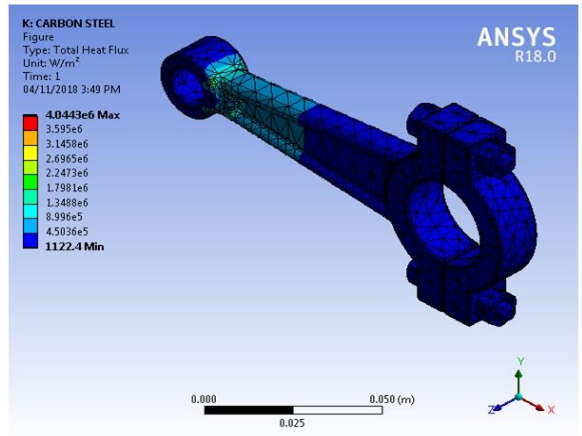


Fig.14 Total Heat Flex

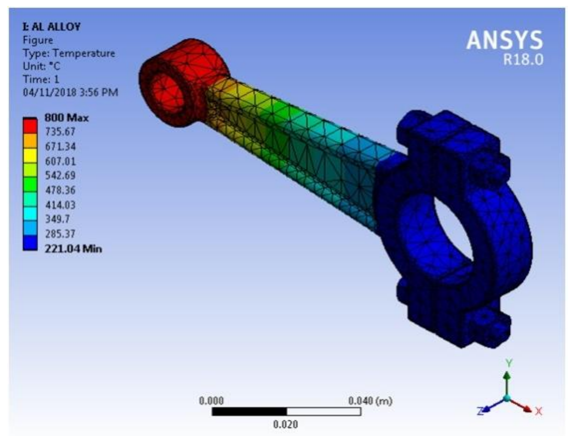


Fig.15 Temperature analysis

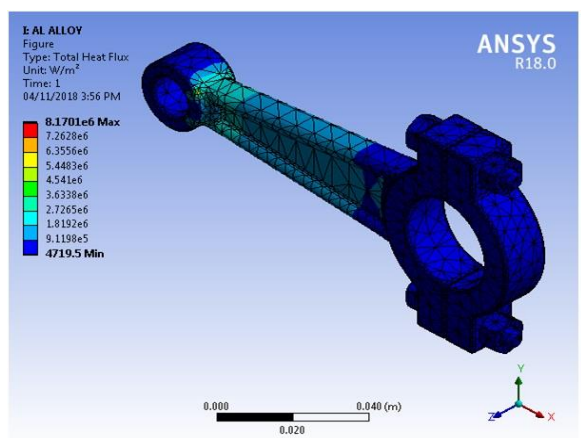


Fig.16 Total Heat Flux

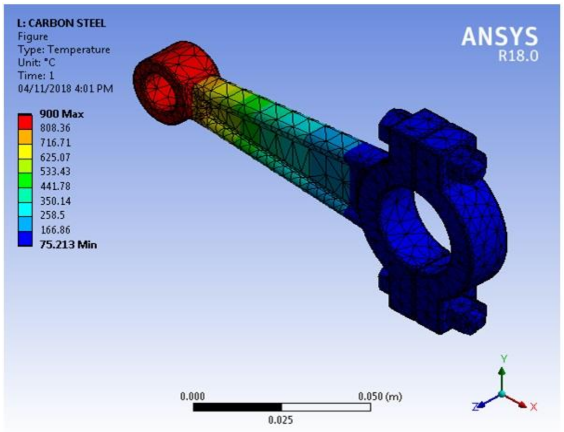


Fig.17 Temperature Analysis

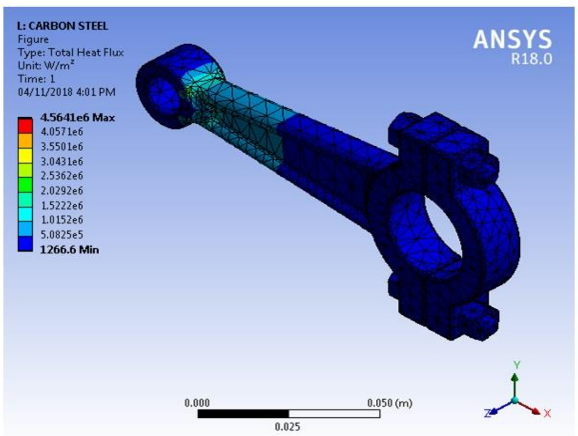


Fig.18 Total Heat Flux

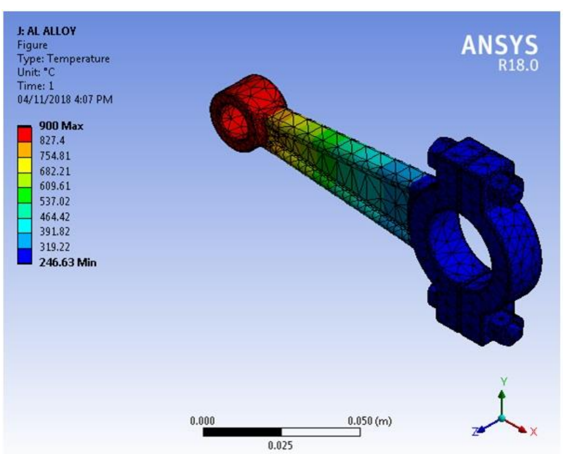


Fig.19 Temperature Analysis

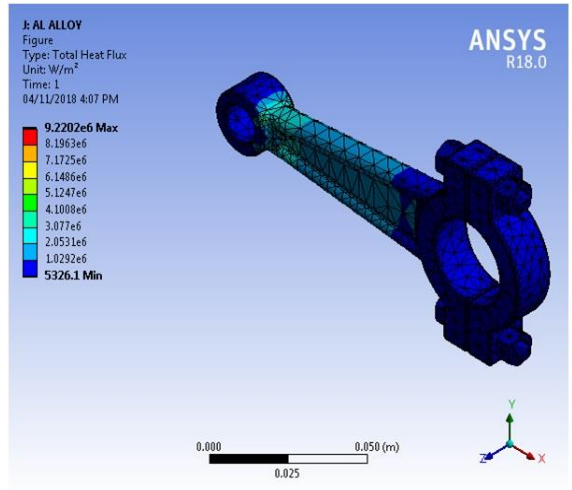


Fig.20 Total Heat Flex

6. COMPARISON

	CARBON STEEL	ALUMINUM ALLOY	CARBON STEEL	ALUMINUM ALLOY	CARBON STEEL	ALUMINUM ALLOY
	700°C		900°C		900°C	
Temperature	63.091	195.46	69.152	221.04	75.213	246.63
Total Heat Flux	978.11	4112.9	1122.4	4719.5	1266.6	5326.1

Table 1. By comparing with the two material at the different temperatures, the Carbon steel has lower heat flux than the Aluminum alloy.

7. CONCLUSION

According to this project we are changing the materials with different temperature to the connecting rod and do the analysis on connecting rod and compare the two materials heat flux at different temperatures. By the above result, concluded that The Carbon steel is better than Aluminum alloy.

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