Comparative Study on Different Materials for Connecting Rod

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Abstract-The most unavoidable part in I C engine is connecting rod. Connecting rods are used for transmitting the power generated at the piston head due to combustion of fuel in combustion chamber of an IC engine to the crankshaft effectively. Connecting rod has two ends. The small end is connected to piston via gudgeon pin and it has linear reciprocating motion, while big end is connected to crankshaft using crank pin. The reciprocating motion generated during the transmission of brake power at piston head causes various stress to acts on the connecting rod. Therefore it is necessary to study different materials which can be used for manufacturing of connecting rod

Keywords – : connecting rod, aluminium, steel, titanium, materials.

I. INTRODUCTION

The connecting rod is used to transmit the piston load to the crankshaft, thus converting the reciprocating motion of piston into a rotary motion at the crankshaft. Small end of connecting rod is connected to piston and big end to crankpin. Connecting rod is subjected to very high inertia forces, axial forces, bending forces generated due to high speed during its operation.

There is mass production of connecting rod around the global and as it works under tensile and compressive loads. From ancient times and today also it is very necessary to minimize stress, weight, strain etc. The connecting rod has a tremendous field of research. In addition to this, vehicle construction led the invention and implementation of quite new materials which are light and meet design requirements. And the optimization of connecting rod had already started as early year 1983 by Webster and his team. Stress and strain on connecting will definitely increase the efficiency, economy and performance of engine.

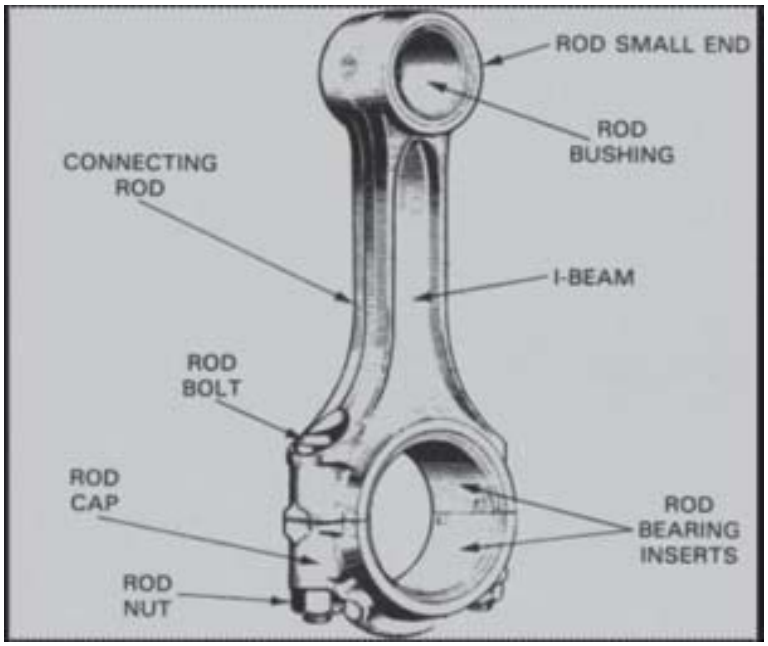


Fig 1: Connecting rod [1].

Connecting rods are classified as follows:

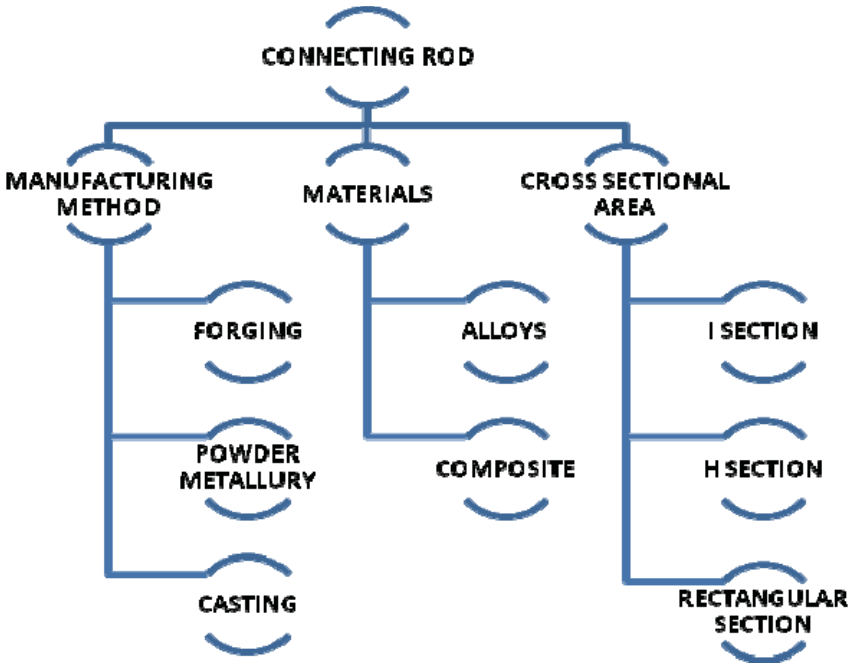


Figure 2. Classification of connecting rod

Properties of materials

1. *Aluminium :*

Aluminium is obtain from mineral bauxite from which it is extracted by Bayer's process. Density of aluminium is 1/3 of steel. It is one of lightest material for manufacturing of connecting rods along superior strength. Aluminium also possess resistance to corrosion thus making it an optimum choice for its use in corrosive environments. Due to its ability to resist thermal stress in low temperatures it is widely used in cold environmental conditions. It also possess good thermal and electrical properties. Aluminium as a material used for manufacturing is non-hazardous for environment being a nontoxic element.

2. Steel:

Steel is obtained by alloying of iron with other elements like tungsten, chromium, manganese, nickel, cobalt, titanium etc. The strength of steel depends upon the chemical composition of the alloying elements and the percentage of carbon content in it. Comparing the properties of aluminium and steel, steel is less compatible than aluminium in cold regions. Steel also corrosion resistance and the ability of steel to resist corrosion also depends upon the percentage of the alloying elements which are resistant to corrosion.

3. Titanium:

Titanium is a metal which had low density along with high strength. Thus titanium is used in applications where high strength is required along with low weight. It is also resistant to corrosion as well as being able to withstand very low temperatures. Being a bad conductor of heat and electricity it is also non-magnetic substance. Titanium is non-toxic element thus it does not pollute the environment. It quite stronger than steel and denser than aluminium but lighter in weight. Its strength can be increased according to its applications by alloying it with different elements like iron, vanadium, aluminium, molybdenum etc.

II. LITERATURE SURVEY

Connecting rod can be made up of different materials such as aluminium, steel, titanium, chrome and chrome vanadium steels and many other alloys.

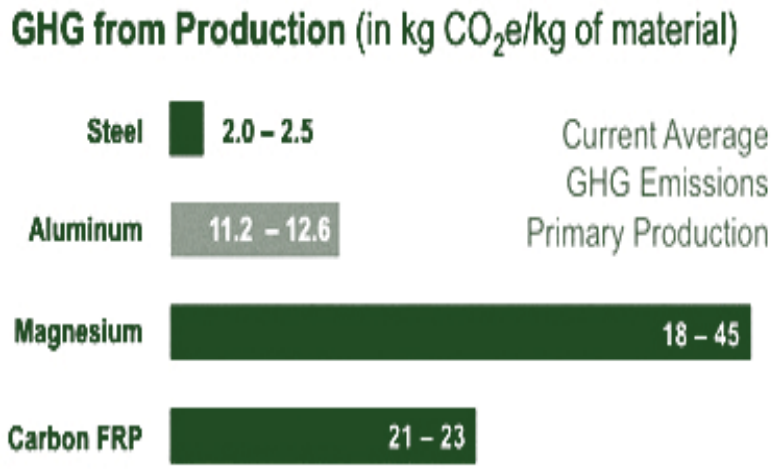
How to choose right material for manufacturing of connecting rod

ALUMINIUM CONNECTING RODS:
Aluminium material can be used for manufacturing of connecting rod due to its light weight preferred over steel and titanium materials and also has high shocking absorbing capacity. It possess superior strength ratio than steel. Aluminium alloys like aluminium 6061, aluminium 7075 can also be used instead of steel. Connecting rods made up of aluminium are also preferred in drag cars because of lightness and cheap costing than steel and titanium.

Fig 3. Aluminium connecting rod

STEEL CONNECTING RODS:

Latest trend engines use steel as material for connecting rod due to its stability, durability, high tensile strength and again big factor weight. Other factors like Heat treatment, ductility, drawing and grain structure also plays critical importance in quality of steel.



Steel is advantageous for vehicles during driving, manufacturing and can be recycled. Pollution caused by steel products is comparatively low than materials and hence environmentally effective.

Fig 4. Steel connecting rod

TITANIUM CONNECTING RODS:

Connecting rod made up titanium materials are expensive rather than steel and aluminium. These are mainly used for high performance of engine. Titanium materials are denser properties than aluminium particles. Elongation of connecting rod can also be increased. Disadvantage of this material is their fatigue property.

Fig 5. Titanium connecting rod

III. CONCLUSION

Connecting rod is most crucial part of an IC engine. Production of connecting rod can be done by using different techniques depending upon the materials and area of cross section. Material selection is important parameter for production of connecting rod. There are numerous materials from which connecting rod can be manufactured. Materials have their strength and stiffness. Thus in this paper we have studied material choice for connecting rod.

IV. FUTURE SCOPE

After reviewing this paper a lot of research work can be done on choice of materials for connecting rod, their properties and hybrid materials can be used widely instead of other materials and cost can be reduce effectively.

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