ABSTRACT

The main purpose of this research work is to offer a better material for manufacturing Bushing used at the small end of connecting rod. We know the function of connecting rod and its assembly’s importance in the internal combustion engine. The main function of connecting rod is to assist in converting reciprocating motion into the rotary motion and that way converting thermal energy into the mechanical energy. It is observed that nearly one third powers is lost due to friction in the I.C. engine. All vehicle manufacturers are trying to minimize power lost due to friction by way of either adopting advanced manufacturing technology or using a new material which reduce the friction between contacting surfaces.

This research work is divided into three parts. In the first part, we have tried to understand the conventional bearing manufacturing technology and different copper alloying materials used for the manufacturing of bushing along with the combination of Lead, Zinc, tin, Phosphorous etc. Brass and Gunmetal are the two popular metals which are used for manufacturing bushing. If we study the structure of conventional bearing materials, we would find that Zinc, Tin and Lead are the chief constituents along with copper. Particularly Lead is more harmful to the human being. Brass and Gunmetal are pretty heavy compared to non metallic materials. Non metallic materials like Rubber, PTFE, Teflon, Nylon etc. are used for the manufacturing of sleeve bearing. They are having good properties like low coefficient of friction, good corrosion resistance etc.

In the second part of research work we used ProE software as the tool and prepared a solid model for the small end of connecting rod bushing. The solid model of Bushing was used for the structural analysis in the Pro Mechanica software. A static analysis was carried out for all three materials i.e. Brass, Gunmetal and Cast Nylon at different values of bearing pressure. The reason to go for static analysis was to consider effect of gas pressure developed inside the piston due to ignition of fuel. If we consider mass of connecting rod which is relatively low, around 90° with crank will have higher value of inertia force but at that stage gas pressure would reduce considerable. Therefore, for all cases of analysis we consider static structural analysis. At the end we found that cast nylon is nearly equally strong compared to Brass and Gunmetal. Also if we consider compressive strength of Cast Nylon there is no any kinds of problem comparing with the analysis result.
In the third and last part of the research work we tried to check material’s tribological behaviour. We know that tribology is the very vital and important branch for the engineering application point of view particularly when two surfaces are moving and in contact with each other. Tribology is the science dealt with friction and wear which are important points we need to consider for the journal bearing application along with lubricants. Many bearings fail either due to lack of lubrication or due to excessive wear out of the material. First we checked three material pins wear having 10 mm diameter and 100 mm length. “Pin-on-disc friction and wear monitor TR20”, Ducom make, Bangalore based company’s machine was used for this purpose. On every 10 seconds reading were recorded for the span of 60 minutes. We found that Cast Nylon material is better compared to Brass and Gunmetal. After that three bushings (Brass, Gun metal and Cast Nylon) were used for experimental validation work. We found that Cast Nylon having less co efficient of friction for same operating condition i.e. same speed, load and lubricant. Also wear were found less in the case of Cast Nylon. We can say Cast Nylon material is quite cheap and economical with respect to Brass and Nylon.

We conclude that if we replace conventional bearing for lighter load and slow speed diesel engine by Cast Nylon, we can improve bearing performance. Also cost wise the manufacturing cost is considerably low. Therefore, we can have optimization in terms of performance and cost by way of replacing Cast Nylon as the bearing material.