



**REUSING OF GRAPHITE FROM WASTE
BATTERIES AS ADDITIVES IN LUBRICANT
TO ENHANCE THE TRIBOLOGICAL AND
RHEOLOGICAL PROPERTIES OF THE
ENGINE OIL**

A PROJECT REPORT

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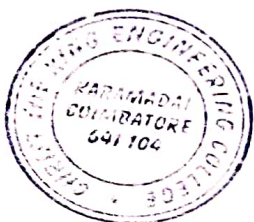
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MECHANICAL ENGINEERING

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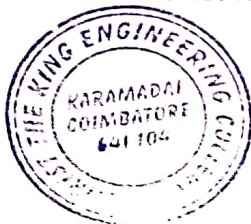
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ABSTRACT

This project deals with research on graphite particles as additives when added with engine oil as lubricant which was developed in order to increase the efficiency of the engine and to analyze the tribological characteristics of the oil. Graphite is used as nano particles since it is a good solid lubricant which provides cleanliness compared to oil lubricants and can provide lubrication at extreme temperature. The carbon atoms are strongly bonded together in sheets. Because the bonds between the sheets are weak, graphite shows low shearing strength under friction force. The graphite rod is extracted from the used Zinc-carbon batteries and converted into micro and nano particles by steel filter mesh and ball milling respectively. The converted micro and nano powder is tested for their particle size by various processes such as SEM, XRD, HRTEM and then mixed with the SAE20W-40 engine oil on different concentrations (0.15, 0.25, 0.5, 0.75wt% of engine oil) by over-head stirrer and ultrasonication process. The mixed oil is then tested and analyzed for their properties such as thermal conductivity, viscosity and pH value. The changes in properties of oil with graphite additives are compared with engine oil without any graphite additives. The results obtained from the tests of engine oil without any additives, engine oil with graphite micro and nano particles additives of different concentrations are analyzed and the one with the desired value is chosen for use.

Keywords: Tribology, graphite micro and nano particles , Zinc-Carbon batteries



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CHAPTER 5

CONCLUSION

5.1 INTRODUCTION

This project explicitly shows the great rheological properties of the graphite particles not only in dry form, but also as additive in liquid lubricant. It effectively increases thermal conductivity and viscosity under different working conditions and proves to be the best additive for engine oil. Since graphite from waste batteries of electric vehicles are going to be dumped into our environment uselessly, it can be recycled and used in the field of tribology for lubrication purpose. So that the demand for graphite in upcoming years could be met by the use of these kind of recycling techniques since graphite holds such rheological properties.

5.2 PRINCIPLE FINDINGS

Following are the findings of these experiments done so far to study the rheological properties of graphite added engine oil.

1. It is found that the thermal conductivity is high for sample C and generally nano lubricant.
2. It is seen that the micro lubricant does not cause much effect when it comes to thermal conductivity.
3. It is also found that the dynamic viscosity increases with the increase in concentration for both nano and micro lubricant.
4. It is found that the nano lubricant's dynamic viscosity is just slightly lesser than micro lubricant's viscosity.

