Production of Lubricant using Sri Lankan Graphite

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Introduction

Graphite is a polymorph of carbon that possesses high electrical conductivity. Most of the industrial applications of graphite exploit this physical property. The loose coupling among the graphite sheets contributes to another industrially important property that enables it to be used as a dry lubricant (Jie, 2012).

Graphite has advantages in situations where wet lubricants might not be practical and also in lubricating porous substances such as wood. Graphite has the natural ability to conduct heat and electricity and is chemically inert. So it can be used as a conductor while lubricating the surfaces. Graphite lubricant enhances load carrying capacity and solves sliding friction problems where conventional lubricants fail to perform and produces better bonding strength. Graphite, being naturally hydrophobic, resists rain, water, snow, and mud and aids in reducing the development of corrosion and rust on valuable equipment (Jie, 2012).

Viscosity is the most important parameter in selecting a lubricant. It changes lubricating properties at different temperature ranges. Therefore it is important to define a temperature range in which the lubricant can be practicable.

Sri Lanka has reputation for its high quality vein graphite. Bogala and Kahatagaha are the main graphite mines in Sri Lanka Kahatagaha graphite is said to be 99% pure crystalline vein graphite. This research focuses on producing a lubricant using Sri Lankan graphite at low cost particularly with the aim of productive utilization of graphite mill waste in future. It investigates the optimum composition of the lubricant compound by testing various materials combinations and concentrations that produce the best lubricity of graphite.

Methodology

Various weight ratios between finely-ground Kahatagaha graphite powder (75µm) and coconut oil, toluene and carbon tetrachloride were used (5% to 60%) as the testing compounds. Viscous graphite/organic liquid mixtures were stirred and blended in fast mill. Viscosity of each mixture was measured by Brookfield Viscometer. The best organic liquid used to produce graphite lubricant was identified based on higher viscosity and the optimum concentration of that compound suitable for industrial applications was determined.

Results and Discussion

The most effective viscosity was obtained after mixing graphite and organic compound in a vibratory ball mill at the frequency of 1500 cycles per minute. Well-blended graphite mixtures result in higher viscosities and the most preferable lubricating properties. Data analysis shows that graphite - coconut oil mixture series yields the highest viscosity (Figure 1).

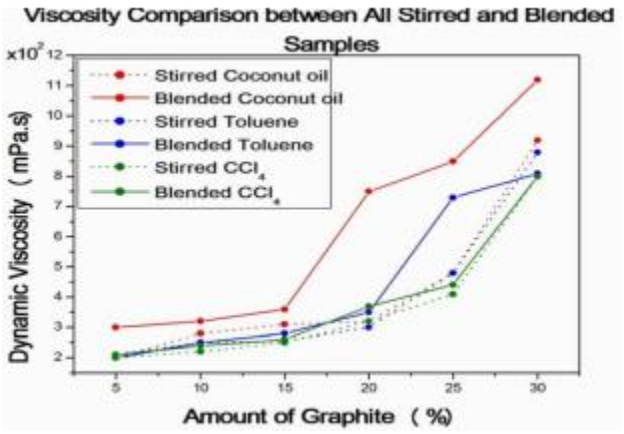

Figure 1. Viscosity Comparison between Stirred and Blended Samples up to 30% of Graphite Composition.

Conclusions

Results suggest that among the coconut oil, toluene and carbon tetrachloride the best organic compound to produce the graphite lubricant is coconut oil. For the best performance it has to be blended in a suitable vibratory ball mill.

This research targets verifying the feasibility of produced lubricant for industrial applications. Industrially applicable extreme pressure lubricants produced by Chevron Company have the viscosity range between 60 mPa.s to 3000 mPa.s. That viscosity range was achieved from 5% to 30% of graphite and organic mixtures under this work. Above 30% may have ability of load carrying capacity under different pressure conditions.

References

Jie, M.W., 2012. What is graphite lubricant. Available from: http://www.ehow.com/about_6385272_graphite-lubricant_.html. [Accessed on 2 October 2013].