Graphene infused Calcium Sulfonate Complex Grease

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Abstract

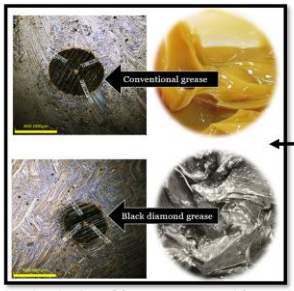
This study presents the development of an innovative grease enhanced with graphene to improve its tribological and thermal characteristics. Various graphene concentrations were evaluated to identify an optimal formulation that balances dispersion stability with performance gains. Four-ball tests conducted in accordance with ASTM D2266 demonstrated a minimum friction reduction of 10% along with notable improvements in thermal behaviour. The optimized graphene-infused calcium sulphonate grease was further assessed in a coal crusher unit at a steel plant over a one-year period. Compared with a parallel crusher operating on standard grease, the graphene-enhanced formulation consistently lowered bearing temperatures and reduced motor current in the monitored crusher (PCR2). On average, bearing temperatures decreased by 15 °C, a change expected to prolong grease life and improve equipment durability following the Arrhenius principle. Additionally, controlled tests showed approximately 3 - 5% lower power consumption. Overall, this formulation offers enhanced efficiency and reliability in crushing operations.

References

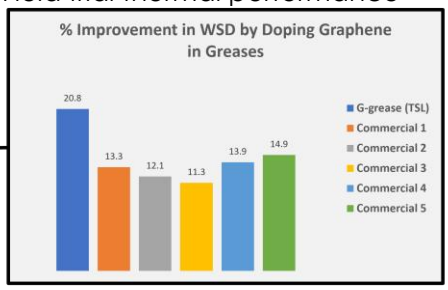
1. Berman, D., Erdemir, A., & Sumant, A. V. Graphene: A new emerging lubricant. Materials Today, (2013) 16(1–2), 10–15.
2. Kumar, R., Rajendran, S., & Rajalakshmi, R. Influence of graphene nanoplatelets on the tribological behavior of lubricating greases. Journal of Molecular Liquids, (2021), 325, 115207.
3. Grease Composition Fortified with Graphene Nanomaterial (2025), India Patent application No. 202531025268

Figures

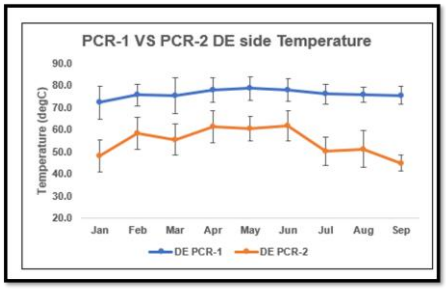
Figure 1: Performance Improvement study of Graphene grease with commercial grease from Lab-scale wear reduction to Field trial thermal performance



Lab study of improvement in WSD using ASTM D2266



Lab study of % improvement in WSD graphene doped our grease vs. graphene doped commercial greases



Field trial study shows consistent improvement in bearing temperature (>15 °C) with Graphene doped grease (PCR-2) vs. commercial grease (PCR-1)