The hBN Nanoparticles as an Effective Additive in Engine Oil to Enhance the Durability and Performance of a Small Diesel Engine

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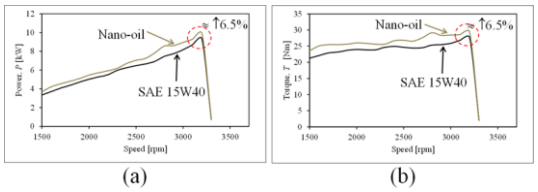
1. INTRODUCTION

With the increase in the number of vehicles, the problems with fuel consumption and environmental pollution are becoming more prominent. The use of an energy-conserving and emission-reducing automotive engine oil additive would have a great impact on energy conservation and environment protection. However, such an additive would need to enhance, or at least maintain the key lubrication properties. Thus, in this work, the potential of hexagonal boron nitride (hBN) nanoparticles as effective additive in SAE 15W40 diesel engine oil [1], to enhance the engine performance and simultaneously reduce frictional wear on the contact surfaces was studied.

2. EXPERIMENTAL METHOD

The nano-oil was prepared by dispersing optimal composition of hBN nanoparticles in 15W40 diesel engine oil using ultrasonic homogenizer [1]. The single cylinder diesel engine performance test was conducted using 20 hp eddy current dynamometer (air cooled type). The torque and power were recorded by DynoMite software. Besides, the surface morphology of piston ring was observed using Scanning Electron Microscopy (SEM).

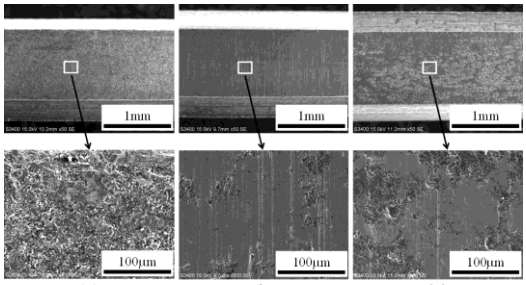


(a) (b)

Figure 1 Nano-oil effectively improve both maximum (a) power and (b) torque of a small diesel engine

3. RESULTS AND DISCUSSION

From Figure 1, both maximum power and torque of the engine improves approximately 6.05% at 3200 rpm when tested using nano-oil. The damage of the piston ring surfaces lubricated by nano-oil due to adhesive wear type with intensive plastic deformation was less pronounced than for conventional diesel engine oil (Figure 2). As shown in Figure 3, boron (B) element entrapped and deposited in the contact areas of piston ring, which is called mending effect, could reduce friction coefficient and consequently a better engine performance.



(a) (b) (c)

Figure 2 SEM micrograph of piston ring surfaces. (a) New piston ring, (b) lubricated with 15W40 diesel engine oil and, (c) lubricated with nano-oil

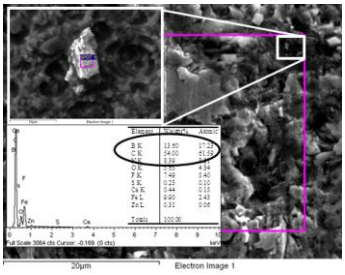


Figure 3 SEM micrograph and EDX spectrum of the piston ring surfaces lubricated with nano-oil

4. CONCLUSION

In summary, addition of optimal composition of hBN nanoparticles in conventional diesel engine oil effectively increasing both maximum power and torque of the engine as well as reduce wear of the engine components.

5. ACKNOWLEDGEMENT

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6. REFERENCE

[1] Abdullah, M.I.H.C., Abdollah, M.F.B., Amiruddin, H., Tamaldin, N. and Mat Nuri, N.R., 2013, Optimization of tribological performance of hBN/Al_2O_3 nanoparticles as engine oil additives, Procedia Engineering, 68, pp. 313-319.