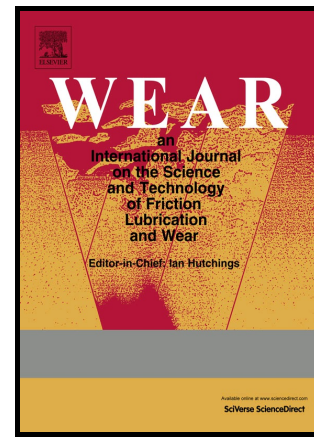


## Author's Accepted Manuscript

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[www.elsevier.com/locate/wear](http://www.elsevier.com/locate/wear)

PII: S0043-1648(16)30180-6  
DOI: <http://dx.doi.org/10.1016/j.wear.2016.08.005>  
Reference: WEA101756

To appear in: *Wear*

Received date: 20 April 2016  
Revised date: 6 August 2016  
Accepted date: 12 August 2016

Cite this article as: Mohamed Kamal Ahmed Ali, Hou Xianjun, Liqiang Mai, Chen Bicheng, Richard Fiifi Turkson and Cai Qingping, Reducing Frictional Power Losses and Improving the Scuffing Resistance in Automotive Engine Using Hybrid Nanomaterials as Nano-Lubricant Additives, *Wear* <http://dx.doi.org/10.1016/j.wear.2016.08.005>

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## Reducing Frictional Power Losses and Improving the Scuffing Resistance in Automotive Engines Using Hybrid Nanomaterials as Nano-Lubricant Additives

Mohamed Kamal Ahmed Ali <sup>\*1,3</sup>, Hou Xianjun <sup>\*1</sup>, Liqiang Mai <sup>2</sup>, Chen Bicheng <sup>1</sup>,  
Richard Fiifi Turkson <sup>1,4</sup>, Cai Qingping <sup>1</sup>.

<sup>1</sup> Hubei Key Laboratory of Advanced Technology for Automotive Components, Wuhan University of Technology, Wuhan 430070, China. <sup>2</sup> State Key Laboratory of Advanced Technology for Materials Synthesis and Processing, Wuhan University of Technology, Wuhan 430070, China. <sup>3</sup> Automotive and Tractors Engineering Department, Faculty of Engineering, Minia University, El-Minia 61111, Egypt. <sup>4</sup> Mechanical Engineering Department, Ho Polytechnic, P.O. Box HP 217, Ho, Ghana.

\* Corresponding Authors: E-mail: eng.m.kamal@mu.edu.eg (M.K.A. Ali) & houxj@whut.edu.cn (H. Xianjun)

### Abstract:

The purpose of this work was to investigate a new nano-additive for improved internal combustion engine oils designed for increased fuel economy and a cleaner environment. The friction and wear characteristics of nano-lubricants containing hybrid nano-materials of Al<sub>2</sub>O<sub>3</sub> and TiO<sub>2</sub> were been evaluated under reciprocating test conditions to simulate a piston ring/cylinder liner contact. Al<sub>2</sub>O<sub>3</sub>/TiO<sub>2</sub> nanoparticles were suspended in a commercially available lubricant in various concentrations. The Al<sub>2</sub>O<sub>3</sub> and TiO<sub>2</sub> nanoparticles had sizes of 8-12 nm and 10 nm, respectively. The morphology and microstructure of the tribofilms produced during frictional contact were investigated via FE-SEM, EDS and a 3-D surface profiler. In the best case, there was a reduction of frictional power losses for the simulated piston ring assembly by 40-51% compared to a commercially available lubricant. The nano-additive composition in that case was 0.05 wt.% Al<sub>2</sub>O<sub>3</sub>+0.05 wt.% TiO<sub>2</sub>. Moreover, the wear rate of piston ring decreased by 17% after a sliding of 50 km due to the delamination of Al<sub>2</sub>O<sub>3</sub> and TiO<sub>2</sub> nanoparticles on worn surfaces. In that case, they acted as a solid lubricant to reduce both wear and scuffing. These results present a

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