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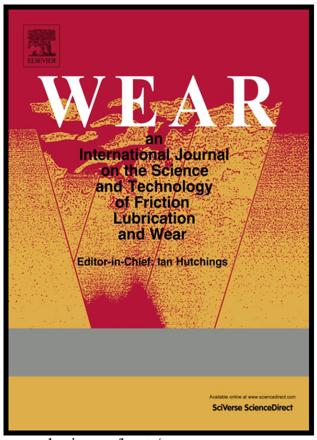

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Reducing Frictional Power Losses and Improving the Scuffing Resistance in Automotive Engines Using Hybrid Nanomaterials as Nano-Lubricant Additives

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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_2O_3 and TiO_2 were been evaluated under reciprocating test conditions to simulate a piston ring/cylinder liner contact. Al_2O_3/TiO_2 nanoparticles were suspended in a commercially available lubricant in various concentrations. The Al_2O_3 and TiO_2 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_2O_3+0.05 wt.% TiO_2. Moreover, the wear rate of piston ring decreased by 17% after a sliding of 50 km due to the delamination of Al_2O_3 and TiO_2 nanoparticles on worn surfaces. In that case, they acted as a solid lubricant to reduce both wear and scuffing. These results present a