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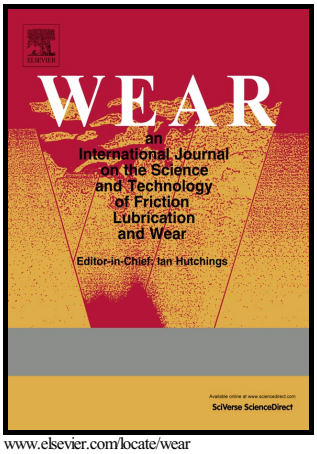

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Friction **wear** characteristics of diamond-like carbon coatings in oils containing molybdenum dialkylthiocarbamate additive

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ABSTRACT

Diamond-like carbon (DLC) coatings are typically used to reduce the friction of sliding parts in automobiles. However, the utilization of DLC coatings in oils containing molybdenum dithiocarbamate (MoDTC) additive causes severe wear of these parts. In this work, we modified the compositions of DLC coatings by varying the cathodic arc deposition process conditions and investigated the effects of the modified compositions on the coating **wear** properties. The results showed that the **wear** loss of the DLC coatings increased with the increasing hydrogen concentration or ratio between the sp^2- and sp^3-hybridized carbon atoms. In addition, the molybdenum oxide species produced during the MoDTC decomposition interacted with the double bonds of the DLC coatings, leading to their cleavage.

Keywords:

Internal combustion engines, Carbon-based coatings (inc. DLC), Lubricant additives, Sliding wear, Wear modeling

1. Introduction

In the automobile industry, the improvement of fuel efficiency is considered an important task for reducing the level of gas emissions to combat global warming and mitigate the steep increase in the price of crude oil. To this end, it is necessary to optimize parameters like thermal efficiencies of the engine and drivetrain, mass of the vehicle body, and air resistance. According to predictions made by the Japanese Society of Tribologists, of the total fuel consumption at a speed of 60 km/h on flat ground, 60% is lost due to exhaust/cooling loss, while the remaining 40% is the theoretical driving output [1]. However, the total fuel consumption is further reduced to 25% due to friction of the metallic parts inside the engine, transmission, and differential. Therefore, mitigating friction losses can increase the driving power of the vehicle and thus, improve its overall fuel efficiency.