PO1069

Hydrogen Content Variation for Enhancing the Lubricated Tribological Performance of DLC Coatings

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Nowadays, there is an increasing demand on energy, which causes the primary energy costs especially fuel prices to rise. Additionally, CO_2 emission also increases due to growing energy consumption. However, CO_2 emission should be reduced to 8 % of the value of 1990 till 2012 according to the Kyoto protocol. A considerably amount of CO_2 is produced by transporting vehicles. In order to fulfill the requirements and reduce fuel consumption, there is a great necessity of increasing the efficiency of vehicles and hence the machine parts. The excellent tribological performance of DLC coatings, which provide low friction and wear resistance in boundary and mixed lubrication regime, promises appropriate surfaces for increasing system efficiency and reducing power losses. The main objective using of DLC coatings with lubricants is to increase the efficiency not only during dry-running, but also during normal operation. Therefore, the DLC and lubricant pair should be optimized for each other. But the interactions between DLC and lubricants are still not clear. Furthermore, DLC coated surfaces differ from conventional ferrous surfaces, for which the lubricants are originally developed. On such surfaces wettability, which arises from physical interactions, plays an important role. The wettability of surfaces depends on the surface free energy of the coatings and lubricants. Hence, adaptation of surface free energy of DLC for a better wettability with a lubricant may allow increasing the performance of the tribological system, tremendously. In this study the influence of the hydrogen content on the tribological performance of DLC coatings with TMP-Ester is investigated. Two different types of DLC coatings, a-C:H:Me and a-C:H are considered. The hydrogen content of both coatings is varied. The effect of the hydrogen content on the surface free energy of the DLC coatings are determined by means of contact angle measurements. The friction behavior of the coatings with TMP-Ester is examined in a pin-on-disk tribometer. The results of the wettability, tribological performance and the hydrogen content are correlated. The results show that increase in hydrogen content improves the wettability, which in return improves the tribological behavior, considerably.

Keywords
DLC
Wettability
hydrogen content