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THE EFFECT OF MoDTC PARTICLES ON WEAR PROPERTIES OF DLC UNDER BOUNDARY LUBRICATION

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ABSTRACT

The wear acceleration of Diamond-Like Carbon by additives were one of the problems to apply it to conventional automobiles' parts. The wear mechanism of DLC-Si under boundary lubrication condition with several additives has been discussed in the automobile industry. The main purpose of this research was that oil additives shows wear acceleration ability or not.

Keywords: diamond-like carbon, MoDTC, boundary lubrication, poly- α -olefin.

INTRODUCTION

Low friction coefficient under boundary lubrication can save energy consumption of automobile, which is highly required. Many contact parts are suffered friction and wear under boundary lubrication conditions at contact points, then they should be kept appropriate operating conditions with long expectancy, replacement easiness and small volume of themselves. Diamond-Like Carbon (DLC) is one of the potential candidates to give low friction, long life time because of its high hardness and chemical inertness. The low friction property of DLC under boundary lubrication is one of the optimistic components of sliding parts in automobile, therefore, many researchers want to know basic potential of many types of DLC using with several additives (Kalin, 2008). One of the worse wear condition of DLC was reported that tetrahedral amorphous carbon (ta-C) slid under poly-alphaolefine (PAO) with glycerol-mono-oleate (GMO) showed higher wear volume than only PAO condition (Tasdemir, 2014). On the other hand, the wear of hydrogenated DLC with tribo-chemical reaction of additives was also investigated. The mechanism of the high wear property was assumed that molybdenum oxide played an important role to scratch DLC surface as abrasives (Komori, 2015). The important factor to generate low friction and high wear proof of DLC was investigated several researchers using with friction modifiers (Yang, 2014), ZnDTP and/or GMO (Tasdemir, 2013), then some structure formed on DLC by tribo-chemical reaction between steel/DLC was suggested. However, it was still unclear whether MoDTC itself enhances wear of DLC or not. In this study, the particle type MoDTC was prepared to add as an additive in PAO oil. Friction tests and surface observation were carried out.

RESULTS AND CONCLUSIONS

The specific wear rate of DLC-Si with MoDTC particles under PAO lubrication results are shown in Fig. 1. The value of specific wear rate increased with particle's amount. This result

demonstrated that MoDTC particles had wear acceleration ability. According to the specific wear rate reported by the authors (Tokoroyama, 2016), the wear acceleration ability of MoDTC particles were higher than MoO₃ particles. Generally, MoDTC is added to the base oil as liquid additive to protect steel alloys' surface. However, the results mentioned above revealed that it could be a factor of wear acceleration material.

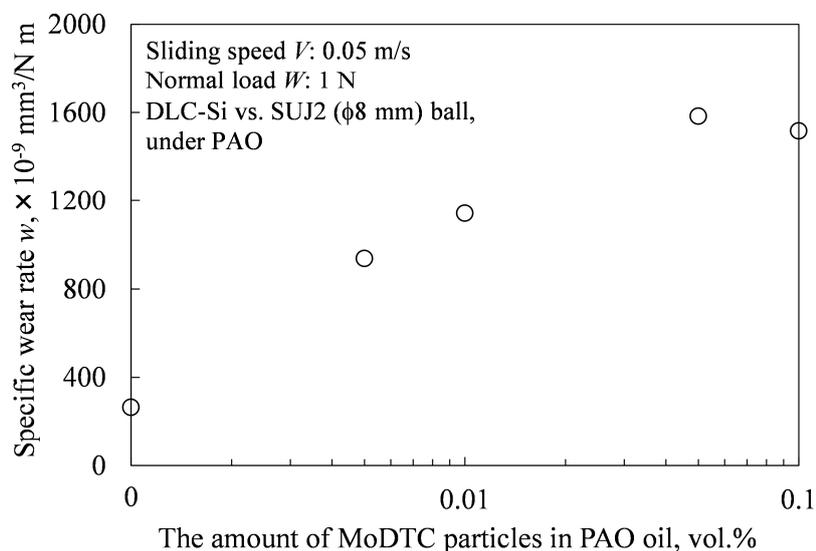


Fig. 1 - The specific wear rate of DLC-Si with MoDTC particles under PAO lubrication

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